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Final Engineering Report

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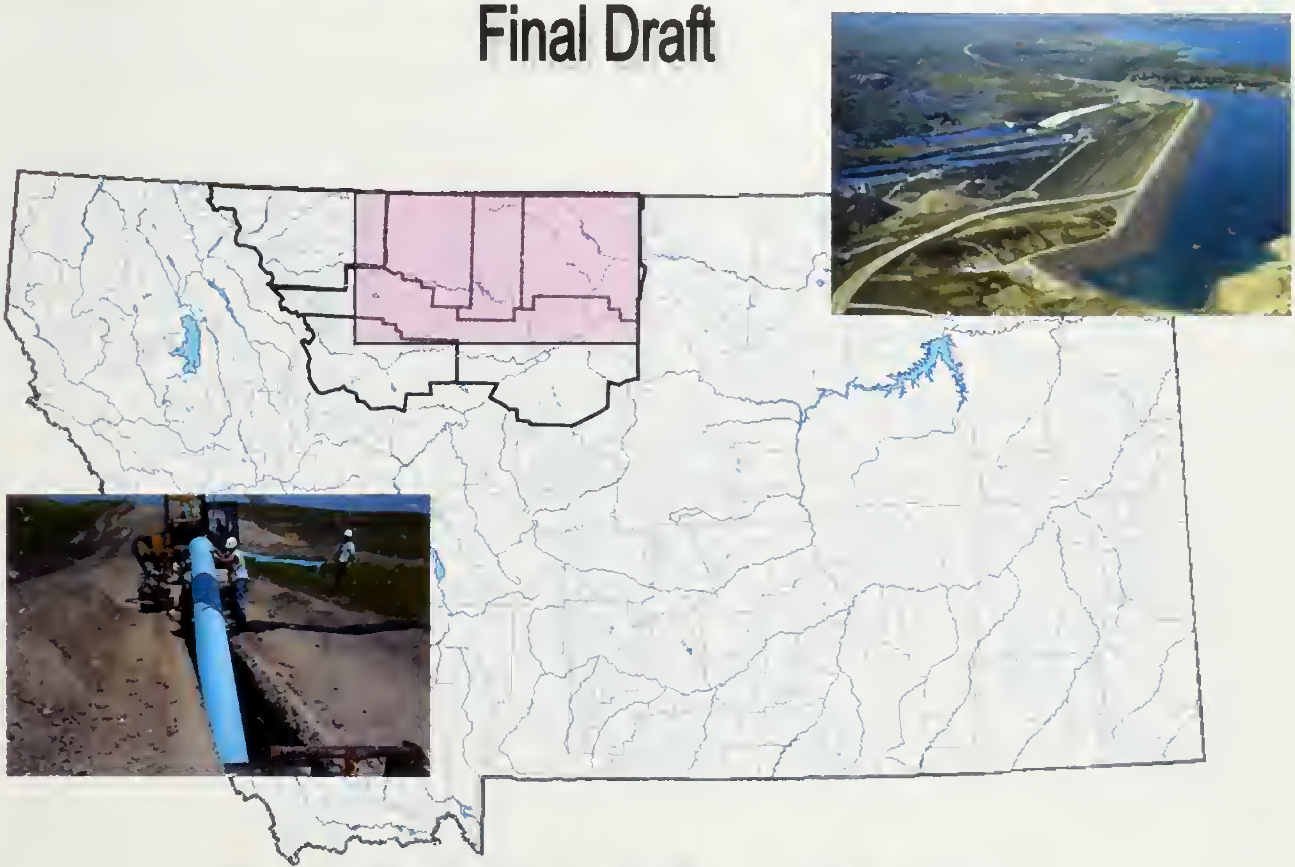

Rocky Boy's / North Central Montana Regional Water System

Prepared for

North Central Montana Regional Water Authority
And
Chippewa-Cree Tribe

STATE [illegible]
MONTANA [illegible]
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September 2004

MAY 30 2006

TABLE OF CONTENTS

Page

1. SUMMARY 1-1
2. INTRODUCTION 2-1
    - 2.1 Statement of Purpose 2-1
    - 2.2 Statement of Scope 2-2
    - 2.3 Definition of Terms 2-2
    - 2.4 Previous Studies/Reports 2-5
    - 2.5 Existing Public Water Systems 2-9
        - 2.5.1 Sources and Treatment 2-9
        - 2.5.2 Water Quality 2-9
        - 2.5.3 Ownership 2-9
    - 2.6 Water Rights 2-9
    - 2.7 Ownership 2-10
3. ECONOMIC AND ENVIRONMENTAL PRINCIPLES AND GUIDELINES ANALYSES 3-1
    - 3.1 Introduction 3-1
    - 3.2 Alternative Plan Formulation 3-1
    - 3.3 Municipal and Industrial (M&I) Evaluation Procedure 3-4
        - 3.3.1 Identification of the Study Area 3-4
        - 3.3.2 Future M&I Water Supplies 3-4
        - 3.3.3 Future M&I Water Use 3-4
        - 3.3.4 Deficit Between Future Water Supplies and Use 3-5
        - 3.3.5 Alternative Without Federal Plan 3-5
        - 3.3.6 Ranking of Alternative Plans based on Least Cost 3-5
        - 3.3.7 Identification of the Most Likely Alternative 3-6
        - 3.3.8 Computation of M&I Water Supply Benefits 3-7
        - 3.3.9 Display 3-7
    - 3.4 Accounts 3-7
        - 3.4.1 Recommended Plan 3-7
4. DEMOGRAPHICS 4-1
    - 4.1 Historic Population and Growth Rates of Project Area 4-1
    - 4.2 Montana Indian Population and Growth Rates 4-1
    - 4.3 Project Population Projection from 2000 Census 4-1
    - 4.4 Historic Water Demands 4-4
5. DESIGN CRITERIA 5-1
    - 5.1 Summary of Design Criteria 5-1
    - 5.2 Water Use Design Criteria 5-2
        - 5.2.1 Reservation Water Needs 5-2
        - 5.2.2 Off-Reservation Water Needs 5-4
    - 5.3 Physical Parameter Design Criteria 5-4
        - 5.3.1 Pressures 5-6
        - 5.3.2 Transmission Pipelines 5-7
        - 5.3.3 Pumping Stations 5-7
        - 5.3.4 Storage 5-7
        - 5.3.5 Reservation Transmission System Sizing 5-8

MAY 30 2006

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TABLE OF CONTENTS

Page

1. SUMMARY 1-1
2. INTRODUCTION 2-1
   - 2.1 Statement of Purpose 2-1
   - 2.2 Statement of Scope 2-2
   - 2.3 Definition of Terms 2-2
   - 2.4 Previous Studies/Reports 2-5
   - 2.5 Existing Public Water Systems 2-9
     - 2.5.1 Sources and Treatment 2-9
     - 2.5.2 Water Quality 2-9
     - 2.5.3 Ownership 2-9
   - 2.6 Water Rights 2-9
   - 2.7 Ownership 2-10
3. ECONOMIC AND ENVIRONMENTAL PRINCIPLES AND GUIDELINES ANALYSES 3-1
   - 3.1 Introduction 3-1
   - 3.2 Alternative Plan Formulation 3-1
   - 3.3 Municipal and Industrial (M&I) Evaluation Procedure 3-4
     - 3.3.1 Identification of the Study Area 3-4
     - 3.3.2 Future M&I Water Supplies 3-4
     - 3.3.3 Future M&I Water Use 3-4
     - 3.3.4 Deficit Between Future Water Supplies and Use 3-5
     - 3.3.5 Alternative Without Federal Plan 3-5
     - 3.3.6 Ranking of Alternative Plans based on Least Cost 3-5
     - 3.3.7 Identification of the Most Likely Alternative 3-6
     - 3.3.8 Computation of M&I Water Supply Benefits 3-7
     - 3.3.9 Display 3-7
   - 3.4 Accounts 3-7
     - 3.4.1 Recommended Plan 3-7
4. DEMOGRAPHICS 4-1
   - 4.1 Historic Population and Growth Rates of Project Area 4-1
   - 4.2 Montana Indian Population and Growth Rates 4-1
   - 4.3 Project Population Projection from 2000 Census 4-1
   - 4.4 Historic Water Demands 4-4
5. DESIGN CRITERIA 5-1
   - 5.1 Summary of Design Criteria 5-1
   - 5.2 Water Use Design Criteria 5-2
     - 5.2.1 Reservation Water Needs 5-2
     - 5.2.2 Off-Reservation Water Needs 5-4
   - 5.3 Physical Parameter Design Criteria 5-4
     - 5.3.1 Pressures 5-6
     - 5.3.2 Transmission Pipelines 5-7
     - 5.3.3 Pumping Stations 5-7
     - 5.3.4 Storage 5-7
     - 5.3.5 Reservation Transmission System Sizing 5-8

6. WATER SUPPLY AND TREATMENT 6-1
6.1 Introduction 6-1
6.2 Basis of Design 6-1
6.2.1 Water Production Requirements 6-1
6.2.2 Water Treatment Components 6-2
6.2.3 Water Quality Goals 6-3
6.3 Raw Water Quality and Finished Water Goals 6-4
6.3.1 Water Quality Data 6-4
6.3.2 Current Regulations 6-9
6.3.3 Future Regulations 6-15
6.3.4 Regulatory Schedule 6-17
6.3.5 Expected Future Regulatory Impacts and Concerns 6-17
6.3.6 Additional Water Quality Data Needed and Summary of Regulatory Impacts 6-19
6.4 Intake and Pump Station 6-19
6.4.1 Alternative 1 Dry Tap 6-21
6.4.2 Alternative 1A Microtunneling 6-22
6.4.3 Alternative 1D Directional Drilling 6-30
6.5 Water Treatment Plant 6-30
6.5.1 Raw Water Storage/Presedimentation 6-33
6.5.2 Pretreatment 6-33
6.5.3 Filtration 6-40
6.5.4 Clearwell 6-44
6.5.5 Disinfection 6-45
6.5.6 High Service/Backwash Pumping 6-48
6.5.7 Chemical Facilities 6-51
6.5.8 Residual Handling Facilities 6-54
6.5.9 Site Layout and Support Facilities 6-55
6.6 Estimated Cost 6-59
6.7 Construction Phasing 6-60
6.8 Additional Technical Investigations 6-61
6.8.1 Pilot Testing 6-62
6.8.2 Geotechnical Investigation 6-63
6.8.3 Topographic Survey 6-63
6.8.4 Real Estate or Easement Acquisition 6-64
7. PIPELINES, PUMPING, AND STORAGE 7-1
7.1 Introduction 7-1
7.2 Disposition of VE Proposals and Items for Further Study 7-1
7.3 Discussion of General Design Methodology 7-3
7.3.1 Sizing 7-3
7.3.2 Pipe Material and Corrosion Protection 7-4
7.3.3 Crossings/Land Acquisition 7-4
7.3.4 Appurtenances 7-5
7.3.5 Pumping Stations 7-6
7.3.6 Storage 7-6
7.4 Pipeline, Pumping, and Storage System Costs 7-7
7.4.1 Pipeline Unit Prices 7-7
7.4.2 Pumping Station Unit Costs 7-7

7.4.3 Storage Tank Unit Costs 7-7
7.5 Description of the Proposed System 7-12
7.5.1 Core System 7-12
7.5.2 Non-Core System 7-17
8. PROJECT COST SUMMARY 8-1
8.1 Project Cost Summary 8-1
8.2 Major Contract Items 8-3
8.2.1 Supervisory Control and Data Acquisition (SCADA) Instrumentation 8-4
8.2.2 Electrical Distribution 8-5
8.2.3 Maintenance Equipment 8-5
8.3 Non-Contract Costs 8-6
8.3.1 Design 8-6
8.3.2 Design Surveys and Geotechnical 8-6
8.3.3 Environmental 8-7
8.3.4 Construction Administration 8-7
8.3.5 Construction / Training / TERO 8-7
8.3.6 Construction Administration / Reclamation 8-8
8.4 Source of Funds 8-9
9. CONSTRUCTION SCHEDULE 9-1
9.1 Construction by Project Segment 9-3
9.2 Activities in Advance of Each Year's Construction 9-4
9.2.1 Preliminary Route 9-6
9.2.2 Permission to Survey and Easement Acquisition: Rocky Boy's Indian Reservation 9-6
9.2.3 Permission to Survey and Easement Acquisition: North Central Montana Rural Water System Authority 9-9
9.2.4 Surveys and Investigations for Engineering, Cultural Resource and Hazardous Waste Purposes 9-9
9.2.5 Permitting 9-10
9.2.6 Design, Design Review and Plan Amendment 9-10
9.2.7 Period of Advertisement, Bid Opening, Notice of Award and Notice to Proceed 9-10
10. OPERATION, MAINTENANCE, AND REPLACEMENT COSTS 10-1
10.1 Electrical Power Source 10-1
10.2 Chemicals 10-1
10.3 Replacement of System Components 10-6
10.4 Labor Costs 10-6
10.5 Operation and Maintenance Manual 10-6
10.6 Operation, Maintenance, and Replacement Responsibilities 10-7

LIST OF FIGURES

Figure 1-1 North Central Montana Regional Water System Components 1-2
Figure 6-1 Water Treatment Plant Schematic 6-5
Figure 6-2 Tiber Locations 6-6
Figure 6-3 Maximum and Average Turbidity for Tiber Reservoir Sampling Locations 6-8
Figure 6-4 Proposed Intake/ Pump Station 6-23
Figure 6-5 Preliminary Pump Station Layout 6-25
Figure 6-6 Proposed Intake Pump Station Site 6-27
Figure 6-7 Plant Flow Schematic 6-31
Figure 6-8 Proposed Site Plan 6-32
Figure 6-9 Conventional Sedimentation Basin 6-34
Figure 6-10 Plate Settling Alternative 6-36
Figure 6-11 Actiflow Sedimentation Basin 6-38
Figure 6-12 Lower Level Filter Building Plan 6-42
Figure 6-13 Clearwell Schematic 6-46
Figure 6-14 High Service Pump Station 6-49
Figure 6-15 Recovery Pump Station 6-56
Figure 7-1 Pump Station Cost Curve (0 – 81 hp Stations) (October 2002 Costs) 7-9
Figure 7-2 Pump Station Cost Curve (1000 – 7000 gpm) (October 2002 Costs) 7-10
Figure 7-3 Concrete Storage Reservoir Costs (October 2002 Costs) 7-11
Figure 7-4 Regional Water System Components 7-13
Figure 7-5 Core Branch of the Water Transmission System 7-14
Figure 7-6 Non-Core Branch of the Water Transmission System 7-18
Figure 7-7 Rocky Boy's Indian Reservation Core and On-Reservation Water System 7-19

LIST OF TABLES

Table 1-1 Project Summary Recommended Plan 1-4
Table 2-1 DEQ Current and Future Compliance Concerns 2-11
Table 3-1 Service Area Alternatives from 1997 Appraisal Study 3-2
Table 3-2 Comparison of Raw Water Sources 3-3
Table 3-3 Ranking of Alternative Plans 3-6
Table 3-4 Environmental Quality Account 3-8
Table 3-5 Other Social Effects 3-9
Table 4-1 Census Counts, North Central Montana Counties 4-2
Table 4-2 Population and Growth Rate of Montana Indians 4-2
Table 4-3 Population Projections 4-3
Table 4-4 Historic Water Demands 4-5
Table 5-1 Design Criteria for the Final Engineering Report 5-1
Table 5-2 Future Reservation Demands 5-3
Table 5-3 North Central System Community Demands 5-5
Table 6-1 Total Organic Carbon (TOC) Concentrations at Sample Point T5 (mg/L) 6-7

Table 6-2 Total Organic Carbon (TOC) Removal Requirements 6-13
Table 6-3 EPA Proposed Bins for Treatment Requirements Based on *Cryptosporidium* Concentration 6-16
Table 6-4 Current and Future Safe Drinking Water Act (SDWA) Regulation Summary 6-18
Table 6-5 Raw Water Quality Sampling Parameters and Frequency 6-20
Table 6-6 Proposed Intake/Pump Station Site 6-21
Table 6-7 Raw Water Pumps 6-28
Table 6-8 Design Criteria for Pretreatment Alternatives 6-39
Table 6-9 Pretreatment Alternative Capital Costs 6-40
Table 6-10 Design Criteria for Filter System 6-41
Table 6-11 Design Criteria for Disinfection 6-48
Table 6-12 High Service Pumps 6-50
Table 6-13 Chemical Feed Summary Table 6-52
Table 6-14 Estimated Opinion of Raw Water Intake, Pump Station, and Water Treatment Plant Capital Costs 6-60
Table 6-15 Example – Phased Construction Strategy 6-61
Table 7-1 Summary of Unit Pipe Costs 7-8
Table 7-2 Summary of Total Pipe Lengths 7-15
Table 7-3 Summary of Total Pipe Costs 7-16
Table 7-4 Summary of On-Reservation Pumping Stations 7-20
Table 7-5 Summary of On-Reservation Storage Tanks 7-21
Table 7-6 Non-Core Pumping Station Summary 7-22
Table 7-7 Non-Core Storage Tank Summary 7-23
Table 8-1 Regional Water System Capital Costs 8-2
Table 8-2 Non-Contract Costs 8-4
Table 8-3 PL 107-331 Act of 2002 and June 2004 FER Project Costs 8-10
Table 9-1 Construction Schedule 9-2
Table 9-2 Illustrative Schedule of Activities in Advance of Construction Start 9-5
Table 10-1 Design Year Operations and Maintenance Costs 10-2
Table 10-2 Life Cycle Costs 10-3
Table 10-3 Off-Reservation Pumping Station, Water Treatment Plant, and Intake Power Requirement Summary 10-4
Table 10-4 On-Reservation Pumping Station Power Requirement Summary 10-5

LIST OF APPENDICES

Appendix A Federal Legislation
Appendix B Water Conservation Plan
(bound separately)
Appendix C Raw Water Data
Appendix D National Primary Drinking Water Standards
Appendix E Detailed Cost Estimate for the Water Treatment Plant
Appendix F Accountability Report
Appendix G Fluoride Fact Sheet
Appendix H North Central System Community Demands
Appendix I Water System Information Gathered by Montana Rural Water Systems, Inc. April 1, 2003

LIST OF ABBREVIATIONS

' - Feet
" - Inch
% - Percent
< - less than
= - Equal
> - greater than
AF - Acre Feet
AFY - Acre Feet per Year
ARM - Administrative Rules of Montana
ASTM - American Society for Testing Materials
AU - Animal Units
AWWA - American Water Works Association
BIA - Bureau of Indian Affairs
BM - Bench Mark
BW - Back Wash
C - Hazen-Williams C. Factor
CDBG - Community Development Block Grant
cm - Centimeter
Co. - Company
CT - Concentration and Time
CTS - Construction Technical Services
CTU - Central Terminal Unit
CWD - County Water District
CY - Cubic Yard
D - Disinfectants
DBP - Disinfection By Products
D/DBP - Disinfection/Disinfection By-Products
DEQ - Montana Department of Environmental Quality
DIP - Ductile Iron Pipe
DIPRA - Ductile Iron Pipe Research Association
DISTR. - Distribution
DNRC - Department of Natural Resources and Conservation
DR - Dimension Ratio
DT - Dry Tap
E - East
EA - Each
EIS - Environmental Impact Statement
EPA - U.S. Environmental Protection Agency
ESWTR - Enhanced Surface Water Treatment Rule
EQ - Environmental Quality
FER - Final Engineering Report
fps - feet per second
ft - Feet

FRP - Fiberglass Reinforced Plastic
FTW - Filter-To-Waste
Furn. - Furniture
FW - Finish Water
GAC - Granular Activated Carbon
gal - Gallons
GWR - Ground Water Rule
GPHPD - Gallons Per Hookup Per Day
gpd/GPD - gallons per day
gpm/GPM - gallons per minute
GPY - Gallons per Year
GWUI - Groundwater Under the Influence of Surface Water
HAA - Haloacetic Acid
HCWP - Hill County Water District
HP - Horsepower
hr - Hour
HS - High Service
HTG - Heating
IDSE - Initial Distribution System Evaluation
ISO - Insurance Services Office
IESWTR - Interim Enhanced Surface Water Treatment Rule
IHS - Indian Health Service
INTERCAP - Intermediate Term Capital Program
kWh - Kilowatt-hours
lbs. - Pounds
LF - Linear Foot
LRAA - Locational Running Annual Averages
LT2ESWTR - Long-term 2 Enhanced Surface Water Treatment Rule
Maint. - Maintenance
MCL - Maximum Contaminant Level
MDT - Montana Department of Transportation
MG - Million Gallons
MGD - Million Gallons per Day
MH - Manhole
mi - Miles
Mill - one thousandth of a dollar
MMI - Man Machine Interface
MPDES - Montana Pollutant Discharge Elimination System
MO - Month
MR&I - Municipal, Rural and Industrial
MRDL - Maximum Residual Disinfectant Levels
MT - Montana
N - North
NED - National Economic Development
NEPA - National Environmental Policy Act

NFF - Needed Fire Flow
NHPA - National Historic Preservation Act
No. - Number
NPDWR - National Primary Drinking Water Regulations
NTU - Nephelometric Turbidity Units
O&M - Operation and Maintenance
OM&R - Operation, Maintenance, and Replacement
OSE - Other Social Effects
P&G - Principles and Guidelines
PAC - Powdered Activated Carbon
PL - Public Law
Pop. - Population
PRV - Pressure Regulating Valve
psi - pounds per square inch
PV - Present Value
PVC - Poly Vinyl Chloride
Q - Flow rate
RD - Rural Development
Reclamation - Bureau of Reclamation
RED - Regional Economic Development
REPL - Replacement
Res. - Reservation
ROW - Right of Way
RRGL - Renewable Resource Grant and Loan
RTU - Remote Terminal Units
RW - Raw Water
S. - Senate
S&GR - Sand and Gravel
SCADA - Supervisory Control and Data Acquisition
SDR - Standard Diameter Ratio
SDWA - Safe Drinking Water Act
SDWIS - Safe Drinking Water Information System
SDS - Sanitation Deficiency System
SRF - State Revolving Fund
Stat. - Statute
STORET - STOrage and RETrieval, EPA water quality database
STTLR. - Settler
SW - Surface Wash
SWTR - Surface Water Treatment Rule
T - Township
TCR - Total Coliform Rule
TERO - Tribal Employment Right Office
THM - Trihalomethane
TOC - Total Organic Carbon
TOT - Total

TSEP - Treasure State Endowment Program
TTHH - Total Trihalomethanes
U.S. - United States
USGS - United States Geological Survey
VAC - Vacuum
VE - Value Engineering
VFD - Variable Frequency Drive
WAPA - Western Area Power Administration
WT - Wet Tap
WTP - Water Treatment Plant
WUA - Water Users Association
yr - Year

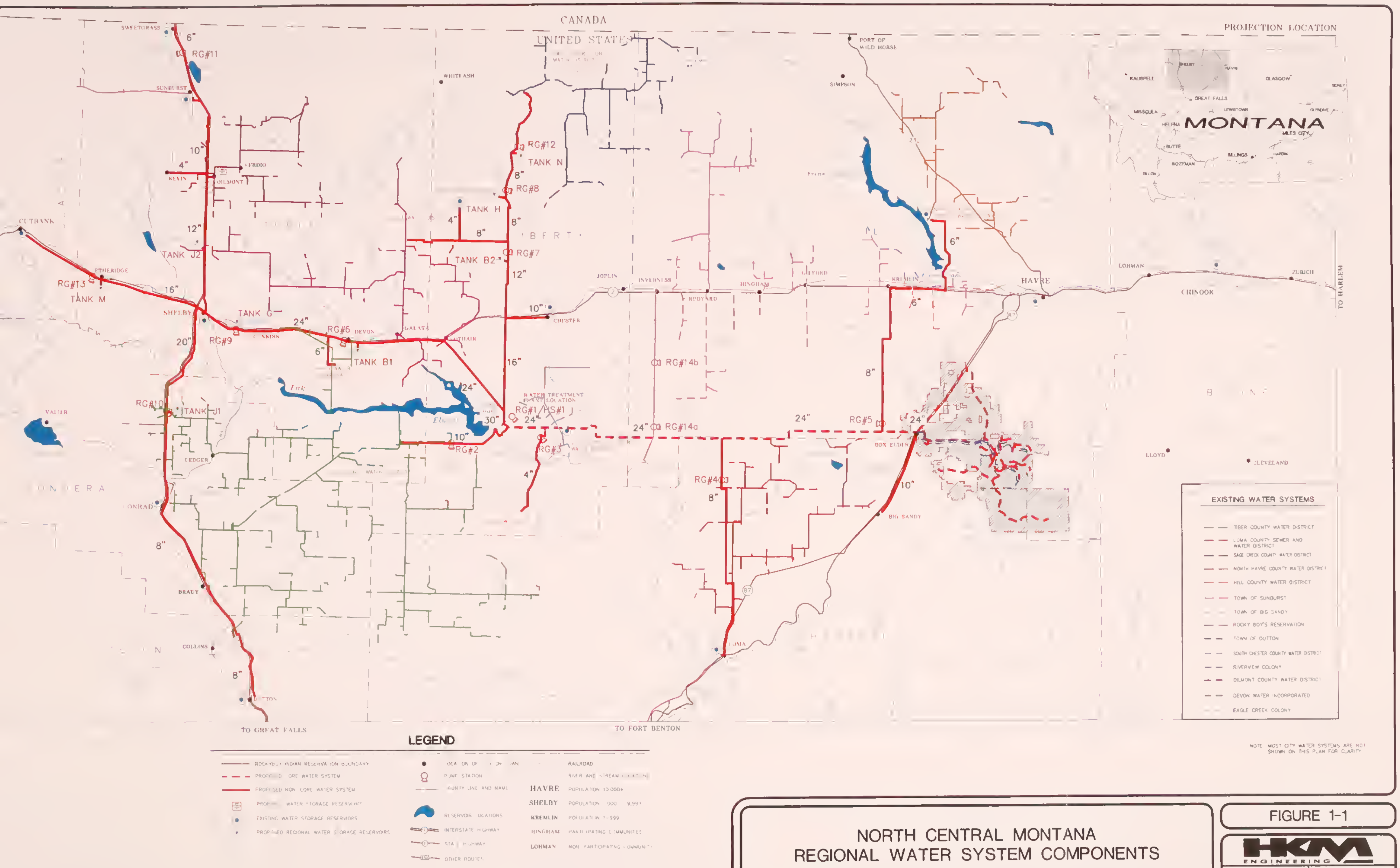

FIGURE 1-1

NORTH CENTRAL MONTANA
REGIONAL WATER SYSTEM COMPONENTS

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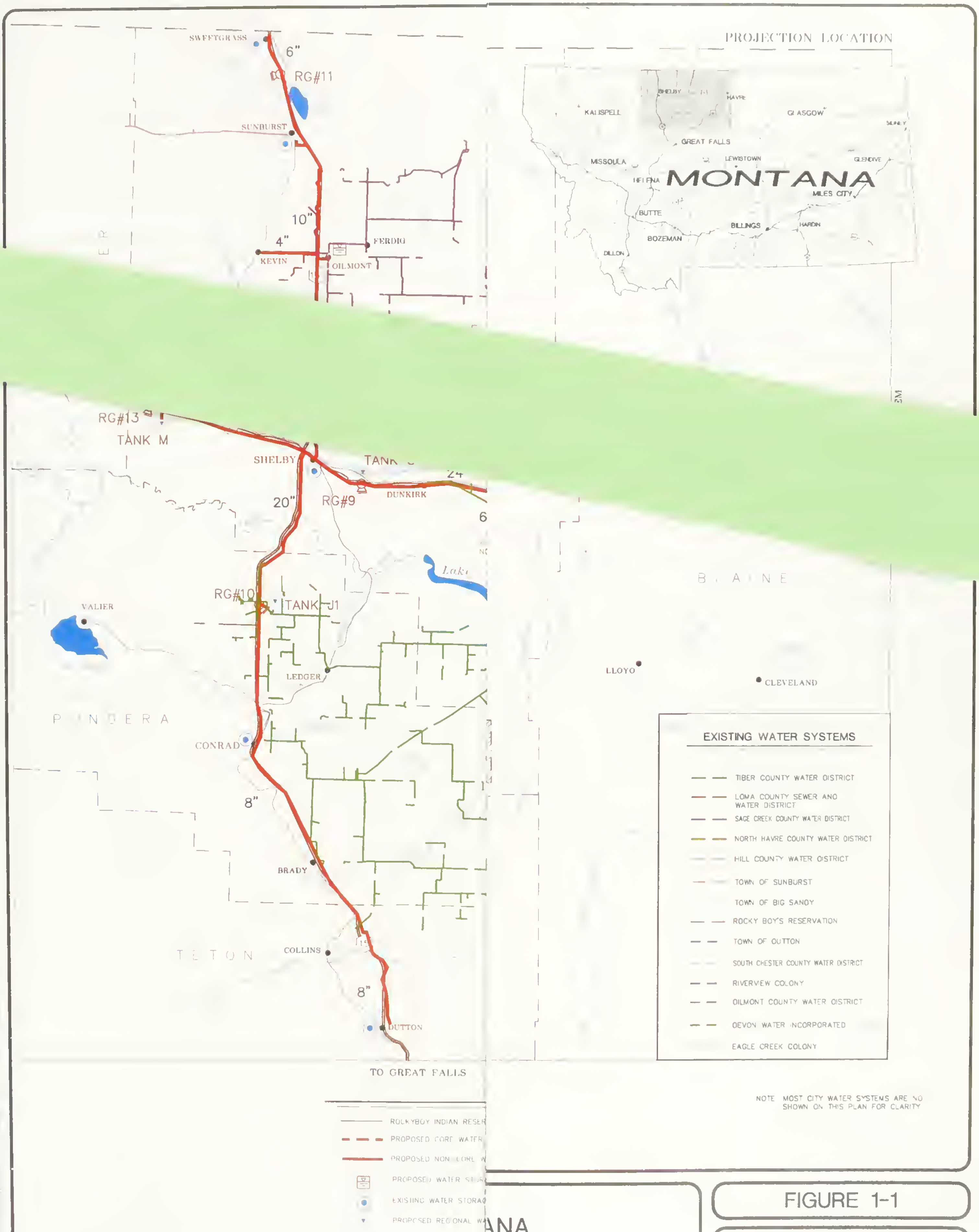

ANA
MPONENTS

FIGURE 1-1

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The project cost presented in the FER is $218,005,008 in year 2002 dollars, which is less than the authorized project cost of $229,000,000.

An economic and environmental Principles and Guidelines (P&G) analysis was performed. The benefits of the federal water supply plan were equal to the cost of the most likely alternative to be implemented. The resulting benefits were $303,012,280 which was the cost of the identified most likely alternative of the Tiber-Conventional Treatment plan. The recommended plan from the P&G analysis was the Tiber-Conventional Treatment alternative.

TABLE 1-1
PROJECT SUMMARY RECOMMENDED PLAN

	Tribal	Non-Tribal	Total
Statistic			
Population			
Current 2000	3,478	16,652	20,130
50 Year Design	12,000	19,393	31,393
Livestock Animal Units	4,000	26,719	30,719
Design Requirements			
Average day w/Losses, gpm	1,721	3,736	5,457
Average day w/Losses, mgd	2.5	5.4	7.9
Peak Day w/Losses, gpm	3,738	10,069	13,807
Peak Day w/Losses, mgd	5.4	14.6	20.0
Peak Day w/Losses & Operational Requirements, mgd	5.7	15.3	21.0
Average Annual Requirements			
Lake Elwell, AF	2,776	6,026	8,802
Project Costs, Millions of \$			
Core, Tiber to Reservation	88.7	34.8	123.5
Non-core	N/A	94.5	94.5
Total	88.7	129.3	218.0
Project Cost Funding by Source, Millions of \$			
Federal Grants	88.7	103.3	192.0
State Grants	---	13.0	13.0
Local Loans	---	13.0	13.0
Total	88.7	129.3	218.0
Annual Operation, Maintenance, and Replacement \$/yr $^{(4)}$	1,412,393	1,351,832	2,764,225
Cost Per 1,000 Gallons, \$ $^{(2)}$	(3)	0.69 $^{(4)}$	N/A
Electrical Cost, \$/yr	172,089	278,255	450,344
Pipelines			
Raw Water, ft	3,000	N/A	3,000
Transmission Mains, mi	105.4	327.6	433.0
Core (1)	52.1	N/A	52.1
Non-core	N/A	327.6	327.6
Reservation Distribution	53.3	N/A	53.3
Pumping Stations			
Core, High Service	1	1	2
Core, Tiber to Reservation	7	0	7
Non-Core	0	14	14
Cost Index Date	December 2002	December 2002	December 2002

(1) Pipelines and pump stations quantities are assumed to be tribal

(2) Cost per 1,000 gallons in December 2002 dollars and based on water sales equal to the projected average day demands for the 50-year design life. This cost does not include debt repayment.

(3) Tribal O&M cost will funded through the O&M Trust Fund

(4) OM&R cost to the Authority based on incremental costs, however, the Tribe, Authority and BIA are currently negotiating OM&R agreements.

2. INTRODUCTION

2.1 STATEMENT OF PURPOSE

The Rocky Boy's/North Central Montana Regional Water System was authorized by Congress by Public Law 107-331 (Appendix A).

The purpose of this final engineering report is to comply with Public Law 107-331.

> **SEC. 906. LIMITATION ON AVAILABILITY OF CONSTRUCTION FUNDS.**
>
> *The Secretary shall not obligate funds for construction of the core system or the noncore system until—*
>
> *(1) the requirements of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) are met with respect to the core system and the noncore system;*
> *(2) the date that is 90 days after the date of submission to Congress of a* ***final engineering report*** *approved and transmitted by the Secretary; and*
> *(3) the Secretary publishes a written finding that the water conservation plan developed under section 911(a) includes prudent and reasonable water conservation measures for the operation of the Rocky Boy's/North Central Montana Regional Water System that have been shown to be economically and financially feasible.*
>
> **SEC. 904. ROCKY BOY'S RURAL WATER SYSTEM.**
>
> *(a)* ***FINAL ENGINEERING REPORT.****—The following reports will serve as the basis for the* ***final engineering report*** *for the Rocky Boy's/North Central Montana Regional Water System—*
> *(1) pursuant to Public Law 104-204, a study, described in section 903(k), that was conducted to study the water and related resources in North Central Montana and to evaluate alternatives for providing a municipal, rural and industrial supply of water to the citizens residing in Chouteau, Glacier, Hill, Liberty, Pondera, Teton, and Toole Counties, Montana, residing both on and off the Reservation; and*
> *(2) pursuant to section 202 of Public Law 106-163, the Tribe has conducted, through a self-governance agreements with the Secretary of the Interior, acting*

> *through the Bureau of Reclamation, a feasibility study to evaluate alternatives for providing a municipal, rural and industrial supply of water to the Reservation.*
>
> *The Secretary of the Interior may require, through the agreements described in subsection (g) and section 905(d), that the **final engineering report** include appropriate additional study and analyses.*
>
> **SEC. 911. WATER CONSERVATION PLAN**
>
> *(a) IN GENERAL. —The Tribe and the Authority shall develop and incorporate into the **final engineering report** a water conservation plan that contains—*
> *(1) a description of water conservation objectives;*
> *(2) a description of appropriate water conservation measures; and*
> *(3) a time schedule for implementing the water conservation measures to meet the water conservation objectives.*

The approved water conservation plan is provided in Appendix B.

2.2 STATEMENT OF SCOPE

The scope of this study includes:

- Reviewing / updating project demographics
- Review / updating design criteria
- Reviewing / updating existing system data
- Preliminary design / layout of water treatment plant and intake
- Refinement of transmission systems
- Updating project costs
- Development of project schedule
- Updating operation and maintenance costs
- Economic and environmental principles and guidelines analysis

2.3 DEFINITION OF TERMS

Pertinent terms defined in Public Law 107-331 are as follows:

SEC. 903. DEFINITIONS.

In this title:

(1) AUTHORITY. —The term "Authority" means the North Central Montana Regional Water Authority established under State law, Mont. Code Ann. 75-6-301, et. seq. (2001), to allow public agencies to join together to secure and provide water for resale.

(2) CORE SYSTEM. —The term "core system" means a component of the water system as described in section 904(d) and the ***final engineering report****.*

(3) ***FINAL ENGINEERING REPORT*** *—The term* ***"final engineering report"*** *means the* ***final engineering report*** *prepared for the Rocky Boy's/North Central Montana Regional Water System, as approved by the Secretary of the Interior.*

(4) FUND —The term "fund" means the Chippewa Cree Water System Operation, Maintenance, and Replacement Trust Fund.

(5) ON-RESERVATION WATER DISTRIBUTION SYSTEMS.—The term "on-reservation water distribution systems" means that portion of the Rocky Boy's/North Central Montana Regional Water System served by the core system and within the boundaries of the Rocky Boy's Reservation. The on-reservation water distribution systems are described in section 904(f) and the ***final engineering report****.*

(6) NONCORE SYSTEM. —The term "noncore system" means the rural water system for Chouteau, Glacier, Hill, Liberty, Pondera, Teton, and Toole Counties, Montana, described in section 905(e) and the ***final engineering report****.*

(7) RESERVATION.—

(A) IN GENERAL.—The term "Reservation" means the Rocky Boy's Reservation in the State of Montana.

(B) INCLUSIONS. —The term "Reservation" includes all land and interests in land that are held in trust by the United States for the Tribe at the time of the enactment of this title.

(8) ROCKY BOY'S/NORTH CENTRAL, MONTANA REGIONAL WATER SYSTEM.—The term "Rocky Boy's/North Central Montana Regional Water System" means—

(A) the core system;

(B) the on-reservation water distribution systems; and

(C) the non-core system.

(9) SECRETARY.—The term "Secretary" means the Secretary of Interior.

(10) STATE.—The term "State" means the State of Montana.

(11) STUDY.—The term "study" means the study entitled "North Central Montana Regional Water System Planning/Environmental Report" dated May 2000.

(12) TRIBE.—The term "Tribe" means—

(A) the Chippewa Cree Tribe of the Rocky Boy's Reservation; and

(B) all officers, agents, and departments of the Tribe.

From section 904(d):

(d) CORE SYSTEM COMPONENTS.—As described in the ***final engineering report****, the core system shall consist of—*

(1) intake, pumping, water storage, and treatment facilities;

(2) transmission pipelines, pumping stations, and storage facilities;

(3) appurtenant buildings, maintenance equipment, and access roads;

(4) all property and property rights necessary for the facilities described in this subsection;

(5) all interconnection facilities at the core pipeline to the noncore system; and

(6) electrical power transmission and distribution facilities necessary for services to core system facilities.

From section 904(f):

(4) COMPONENTS.—As described in the ***final engineering report****, the on-reservation water distribution systems shall consist of—*

(A) water systems in existence on the date of enactment of this title that may be purchased, improved, and repaired in accordance with the Agreements entered into under subsection (g);

(B) water systems owned by individual members of the Tribe and other residents of the Reservation;

(C) any water distribution system that is upgraded to current standards, disconnected from low-quality wells; and

(D) connections.

From section 905(c):

(c) COMPONENTS.—As described in the ***final engineering report****, the components of the noncore system on which Federal funds may be obligated and expended under this section shall include—*

(1) storage, pumping, and pipeline facilities;

(2) appurtenant buildings, maintenance equipment, and access roads;

(3) all property and property rights necessary for the facilities described in this subsection;

(4) electrical power transmission and distribution facilities necessary for service to noncore system facilities; and

(5) other facilities and services customary to the development of rural water distribution system in the State.

2.4 PREVIOUS STUDIES/REPORTS

A Water Rights Compact was entered into by the state of Montana, the Chippewa-Cree Tribe of the Rocky Boy's Reservation and the United States of America in 1997. Public Law 106-163 was signed by President Clinton on 12-9-99. A key element of the Compact was the recognition of the need for imported water to meet the Municipal, Rural and Industrial (MR&I) needs of the Tribe. The Compact includes an allocation of 10,000 acre-feet of water for the Tribe out of Tiber Reservoir to meet future tribal water requirements.

Several alternatives were analyzed during the water rights settlement negotiations for importing water to the Reservation area. Early studies identified Tiber Reservoir, located about 50 miles west of the Reservation, as a potential source of imported water (Figure 1-1).

A number of adjacent municipal and rural water systems expressed an interest in joining with the Rocky Boy's Reservation in a regional water system as a cost-effective means of providing high quality drinking water to an area historically plagued by water supply and quality problems. Water quality compliance problems include Disinfection By-Products (DBP), the Enhanced Surface Water Treatment Rule (ESWTR), Groundwater disinfection rule, Groundwater Under the Influence of Surface Water (GWUI), the lead and copper rule, the Surface Water Treatment Rule (SWTR), and the Total Coliform Rule (TCR).

A Coordinating Committee including members of the Chippewa-Cree Tribe of the Rocky Boy's Reservation and interested water systems was established to coordinate the analysis of a potential regional system. The following municipal and rural water systems were interested in being a part of the proposed regional system:

Town of Big Sandy
Box Elder Water and Sewer District(1)
Brady County Water District(1)
Town of Chester
City of Chinook(1)
City of Conrad
Devon Water Incorporated
Town of Dutton
Eagle Creek Colony
Loma County Sewer and Water District
North Havre County Water District
Oilmont County Water District
Riverview Colony
Rocky Boys' Rural Water System
Sage Creek County Water District
Sage Creek Colony
City of Shelby
South Chester County Water District

Galata County Water District
City of Havre(1)
Hill County Water District
Town of Kevin
Town of Sunburst
Sweetgrass Community Water and Sewer District
Tiber County Water District

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(1) Communities have subsequently chosen to withdraw from the project.

(2) Cut Bank has subsequently joined the project.

A Needs Assessment report was published that identifies the water needs of the interested water systems and evaluated the groundwater and/or surface water sources that have suitable quantity and quality to supply the demands of the study area (MSE-HKM, October 1997). The report concluded that Tiber Reservoir and the Marias and Missouri Rivers have the quality and quantity to supply the proposed regional water system. In addition, the Milk River is a potential water source for a portion of the proposed regional water system. Groundwater was eliminated as a viable water supply for the regional system because of inadequate quantity. It was recommended that an appraisal level engineering study be performed to further evaluate the potential water sources and estimate costs for each water service alternative.

An Appraisal Level Study report was completed which identified the design criteria, the water delivery system configurations, applicable power rates by service area, and construction and life-cycle costs for 14 candidate water service alternatives (MSE-HKM, November 1997). These alternatives included water from the Marias River (Tiber Reservoir), Missouri River, Milk River (Fresno Reservoir via the Havre water intake) and Box Elder Creek (Enlarged Bonneau Reservoir). Special (reverse osmosis) water treatment was considered for use of Missouri River water which has high arsenic concentrations. Two service areas were evaluated. The first consisted of the entire area of study while the second included service only to the Rocky Boy's Reservation.

Of the alternatives supplying the entire project area, options using conventional treatment of Missouri River water and/or Milk River water were not determined to be viable. Conventional treatment of Missouri River water would allow arsenic to be introduced into the Milk River basin causing degradation in water quality of the receiving streams. The future yield of Fresno Reservoir (Milk River) and the availability of direct flow supplies from the Milk River were questioned because of loss of active storage due to the rapid rate of sedimentation, unused Canadian treaty rights and unquantified Indian reserved water rights. The recommended alternative for supplying the entire project area utilized Tiber Reservoir which has a firm water supply and the lowest capital project and life-cycle costs of the viable alternatives. On a life-cycle cost basis, there was little difference between the Tiber Only option and any other alternative.

Of the alternatives that only supply the Reservation portion of the project area, conventional treatment of Missouri River water would result in degradation in water quality of the receiving streams in the Milk River basin. Additionally, local sources of supply were rejected because they are extremely limited and no entity has demonstrated that transferring the Tribe's irrigation rights to MR&I purposes is a viable option. Both of these issues are strongly opposed by the Chippewa-Cree Tribe. The Tiber Reservoir Only option is comparable to the Missouri River, with special treatment, and Bonneau Reservoir alternatives on a life-cycle cost basis.

Based upon the appraisal level study, the Coordinating Committee recommended three alternatives for feasibility level study. Included are: use of Tiber Reservoir to serve all of the interested water systems within the project area; using Tiber Reservoir to serve only the Rocky Boy's Reservation with no action for the remaining water systems; and no action for the entire project area.

A project feasibility analysis (MSE-HKM, 2000) was performed based on the following funding assumptions:

- The "core" system, comprised of the intake at Tiber Reservoir, the raw water pipeline, the water treatment plant, and the transmission pipeline and associated pump stations and reservoirs from Tiber Reservoir to and on the Rocky Boy's Indian Reservation, will be owned by the United States in trust for the Tribe and be 100% federally funded.

- The remaining transmission pipelines and related components serving the non-Indian water users will be owned by the North Central Montana Regional Water Authority. Funding for these components will be funded 75% by federal grants and 25% by state grants and loans.

- State loans would be for 20 years with a 4% rate of interest.

- Operation and Maintenance (O&M) charges associated with building a system that will serve only the Reservation will be 100% federally funded. The non-Indian users will be responsible for the incremental O&M costs of the "core" system (above the tribal only base) plus all the Operation and Maintenance (O&M) costs of the remaining transmission system.

- Estimated water rates for non-Indian water users include capital repayment and O&M charges associated with the regional system, and capital repayment and an estimated 25% of current O&M charges associated with existing individual water systems.

- The existing systems will contribute their existing infrastructures plus be responsible for necessary upgrades.

Results were presented to the participating municipal and rural water systems during a series of public meetings and work sessions. Cost sharing options and project scheduling were discussed and projected monthly costs per household were presented. As a result, the regional study area was reduced as Havre, Chinook, Brady, Kevin and Box Elder chose to no longer be a part of the project. The study area and system capacity were accordingly modified. Concurrently, capacity to service interested individuals, not a part of an existing system, was added to the project. A system sized to serve all of the interested water systems and individuals within the project area would have estimated project (construction) and life-cycle costs of $199,888,200 and $247,864,500, respectively.

The alternative that supplies water to the Rocky Boy's Reservation and surrounding municipal and rural water systems was the alternative chosen by the Coordinating Committee. This alternative would provide municipal water to the Rocky Boy's Reservation, assist in meeting the goals of the Rocky Boy's Water Rights Compact, and provide a cost effective way for the remaining systems to mitigate their present compliance and supply problems.

During the development of the FER, the City of Cut Bank approached the Coordinating Committee about participation in the project. Since Toole County was included in the Federal Authorization, the Coordinating Committee approved the inclusion of Cut Bank in the project. Therefore, the FER was modified to include the City of Cut Bank.

Previous reports include the following:

HKM Engineering Inc. 2003. Rocky Boy Reservation MR&I Water System Concluding Report. Billings, MT: HKM. (Conducted under P.L. 106-163)

MSE-HKM Engineering. 2000. Rocky Boy's/North Central Montana Regional Water System Planning/Environmental Report. Billings, MT: MSE-HKM.

MSE-HKM, Inc. 1997. North Central Montana Regional Water System Appraisal Level Study-Draft. Billings, MT: MSE-HKM.

MSE-HKM, Inc. 1997. North Central Montana Regional Water System Needs Assessment-Preliminary. Billings, MT: MSE-HKM.

Montana Department of Natural Resources and Conservation. 1996. Rocky Boy's/North Central Montana Regional Water Supply System, Off-Reservation Needs Assessment. Helena, MT. DNRC.

2.5 EXISTING PUBLIC WATER SYSTEMS

Water supply surveys of towns, rural areas and the Rocky Boy's Reservation show a patchwork of different systems and water sources with a range of treatment capability.

2.5.1 Sources and Treatment

Water for existing systems comes from tributaries of the Missouri River or groundwater. A variety of treatment methods are utilized. To meet pending EPA drinking water quality requirements, some communities may have to change water sources.

2.5.2 Water Quality

The Montana Department of Environmental Quality (DEQ) prioritized the municipal and rural water systems that have expressed an interest in the regional water system with regard to the expected difficulty meeting future regulatory requirements based on current U.S. Environmental Protection Agency (EPA) regulatory proposals and/or requirements of the 1996 amendments to the SDWA (Table 2-1). Category 3 systems are included because of local concerns of future compliance difficulties even though they are not identified as such by the DEQ.

2.5.3 Ownership

Title to the existing water systems is and will continue to be held by the individual towns, cities, water districts. The existing reservation water systems are and will continue to be held by the federal government in trust for the Tribe.

2.6 WATER RIGHTS

The authorizing legislation for the project (PL 107-331) describes the water rights for the project.

> Authority
>
> SEC. 908. AUTHORIZATION OF CONTRACTS.
>
> The Secretary is authorized to enter into contracts with the Authority for water from Lake Elwell providing for the repayment of its respective share of the construction, operation, maintenance and replacement costs of Tiber dam and reservoir, as determined by the Secretary, in accordance with Federal Reclamation

Law (Act of June 17, 1902, 21 Stat. 388, and Acts amendatory thereof and supplemental thereto).

Tribe

SEC. 909. TIBER RESERVOIR ALLOCATION TO THE TRIBE.

(a) NO DIMINISHMENT OF STORAGE.—In providing for the delivery of water to the noncore system, the Secretary shall not diminish the 10,000 acre-feet per year of water stored for the Tribe pursuant to section 201 of the Chippewa Cree Tribe of The Rocky Boy's Reservation Indian Reserved Water Rights Settlement and Water Supply Enhancement Act of 1999 (Public Law 106-163) in Lake Elwell, Lower Marias Unit, Upper Missouri Division, Pick-Sloan Missouri Basin Program, Montana.

(b) DRAW OF SUPPLY; PURCHASE OF ADDITIONAL WATER.—In providing for delivery of water to Rocky Boy's Indian Reservation for the purposes of this title, the Tribe shall draw its supply from the 10,000 acre-feet per year of water stored for the Tribe pursuant to section 201 of the Chippewa Cree Tribe of The Rocky Boy's Reservation Indian Reserved Water Rights Settlement and Water Supply Act of 1999 (Public Law 106-163) in Lake Elwell, Lower Marias Unit, Upper Missouri Division, Pick-Sloan Missouri Basin Program, Montana. Nothing in this title shall prevent the Tribe from entering into contracts with the Secretary for the purchase of additional water from Lake Elwell.

2.7 OWNERSHIP

The authorizing legislation for the project (PL 107-331) describes the water rights for the project.

Authority (Noncore)

SEC. 905. NONCORE SYSTEM.

(g) TITLE TO NONCORE SYSTEM.—Title to the noncore system shall be held by the Authority.

Tribe (Core)

SEC. 904. ROCKY BOY'S RURAL WATER SYSTEM.

(i) TITLE TO CORE SYSTEM.—Title to the core system—

(1) shall be held in trust by the United States for the Tribe; and

(2) shall not be transferred unless a transfer is authorized by an Act of Congress enacted after the date of enactment of this title.

TABLE 2-1
DEQ CURRENT AND FUTURE COMPLIANCE CONCERNS

Category 1	Category 2	Category 3
1. Hill County WD (SWTR)	1. Hill County WD (DBP, ESWTR)	1. Big Sandy
2. S. Chester WUA (GWUI)	2. Loma WD (DBP, ESWTR)	2. Galata
3. Riverview Colony (GWUI)	3. Tiber WD (DBP, ESWTR)	
4. Sunburst (TCR)	4. North Havre WD (DBP)	
	5. Devon WUA (DBP, ESWTR)	
	6. Sage Creek WD (GWUI)	
	7. Shelby (GWUI)	
	8. Chester (DBP, ESWTR)	
	9. Sweetgrass (DBP, ESWTR)	
	10. Dutton (GWUI)	
	11. Conrad (DBP, ESWTR)	
	12. Oilmont (GWUI, GWR)	

Notes:

Category 1:	Currently out of compliance.
Category 2:	Expected to have difficulty meeting future regulatory requirements based upon current EPA regulatory proposals and/or requirements of the 1996 amendments to the SDWA. Primarily small systems that either utilize surface water or groundwater systems that may be classified as groundwater under the influence of surface water.
Category 3:	Currently in compliance, and expected to be in compliance with future regulatory requirements.

DBP - disinfection by-products
ESWTR - enhanced surface water treatment rule
GWR - ground water rule
GWUI - groundwater under the influence of surface water
SWTR - surface water treatment rule
TCR - total coliform rule

3. ECONOMIC AND ENVIRONMENTAL PRINCIPLES AND GUIDELINES ANALYSES

3.1 INTRODUCTION

Pursuant to the Water Resources Planning Act (PL 89-80), the Water Resources Council developed the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (Principles and Guidelines). The federal objective, as presented in the P&Gs is to:

> *"The Federal objective of water and related land resources project planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements."*

The problems in the project area relative to municipal, rural, and industrial water are poor quality drinking water, major water supply constraints, and high costs for compliance with new federal Safe Drinking Water Act regulations. The opportunities presented by this project are to ensure a safe and adequate MR&I water supply for the residents of the Rocky Boy's Reservation and the citizens residing in Chouteau, Glacier, Hill, Liberty, Pondera, Teton, and Toole Counties in Montana.

3.2 ALTERNATIVE PLAN FORMULATION

Alternative plans for meeting water resource needs were developed by the project sponsors in a 1997 Appraisal Study. This study examined 10 alternatives to supply water to the service area and 4 alternatives to supply water only to the Rocky Boys Reservation. Raw water sources were Lake Elwell (Tiber), the Missouri River, and the Milk River. Some of the alternatives used conventional treatment and others used reversed osmosis treatment. The service area alternatives and their respective capital and lifecycle costs in 1997 are summarized in Table 3-1.

TABLE 3-1
SERVICE AREA ALTERNATIVES FROM 1997 APPRAISAL STUDY

Description	Total Project Cost	Total Life Cycle Cost
TIBER ONLY-CONVENTIONAL TREATMENT	$182,865,000	$237,113,000
MISSOURI ONLY – CONV. TREATMENT	$207,647,000	$282,048,000
MISSOURI ONLY – SPECIAL TREATMENT	$221,900,000	$349,484,000
TIBER & MISSOURI – CONV: -TREATMENT	$176,006,000	$241;278,000
TIBER & MISSOURI - SPECIAL TREAT.(MSSRI)	$190,836,000	$295,861,000
TBR, MSSRI & MLK,CONV. TREATMENT :	$158,927,000	$225,046,000
TBR, MSSRI & MLK - SPEC. TREAT.(MSSRI &MILK)	$161,039,000	$246,057,000
TIBER & MILK - CONV. TREATMENT	$164,216,000	$223,227,000
MSSRI & MILK - CONV. TREATMENT	$191,978,000	$265,440,000
MISSOURI & MILK - SPECIAL TREATMENT(MSSRI)	$199,532,000	$313,214,000

The May 16, 2000 report referenced in the authorizing legislation (PL 107-331) continued the analysis of the alternatives by the project sponsors. In addition to the 10 alternatives from the 1997 report, the sponsors described a No-Action alternative and developed an Alternative Without Federal Plan.

For this P&G analysis, the raw water sources were evaluated for completeness of the plan in meeting the needs, the effectiveness and efficiency in meeting the needs, the efficiency of the plan, and the acceptability of the plan in Table 3-2. This evaluation and the analysis of the data contained in the 1997 and 2000 reports resulted in the following alternatives being carried forward for review under the Principles and Guidelines:

- Alternative Without Federal Plan (no Federal action)
- Missouri Only – Special Treatment
- Tiber Only – Conventional Treatment

The following alternatives were not carried forward for further analysis:

- Missouri River – Conventional Treatment
- Tiber Reservoir and Missouri River – Conventional Treatment
- Tiber Reservoir and Missouri River – Special Treatment
- Tiber Reservoir, Missouri and Milk River – Conventional Treatment
- Tiber Reservoir, Missouri and Milk River – Special Treatment
- Tiber Reservoir, and Milk River – Conventional Treatment
- Missouri and Milk River – Conventional Treatment
- Missouri and Milk River – Special Treatment
- No Action (no Federal or Sponsor action)

TABLE 3-2
COMPARISON OF RAW WATER SOURCES

Alternative	Completeness	Effectiveness	Efficiency	Acceptability	Total
	Extent to which an alternative provides and accounts for all necessary investments or other actions to ensure realization of the planned effects.	Extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities.	Extent to which an alternative plan is the most cost effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment.	Workability and viability of the alternative plan with respect to acceptance by the State and local entities and the public and compatibility with existing laws, regulations, and public policies.	
	1-10 Points	**1-10 Points**	**1-10 Points**	**1-10 Points**	
No Action	0	0	0	0	0
	Does not provide for any investments or other actions to provide water	Does not alleviate the problems or achieve opportunities.	Not cost effective in alleviating the problems	Not acceptable to any entity to not have a solution to the problem	
Alternative Without Federal Plan	8	5	5	5	23
	The costs shown for this alternative are for installation of water treatment facilities in the future. Unknown costs may occur for each system.	It is unknown when each of the systems would install the necessary treatment facilities to alleviate their problems.	The lifecycle cost for this alternative in 1997 dollars was $257 million which is greater than the Tiber Reservoir-Conventional Treatment alternative of $248,000,000.	This alternative is less acceptable to the project sponsors than being served by a single treatment system. This is also less acceptable to the State depending on the degree of compliance issues encountered by the individual systems in the future.	
Tiber Only - Conventional Treatment	10	10	8	10	38
	Cost estimates for this alternative account for the necessary investments	This alternative would alleviate the specified problems.	The lifecycle cost for this alternative is $248 million in 1997 dollars.	This alternative is the most acceptable to all entities.	
Missouri Only - Conventional Treatmen	10	8	6	5	29
	Cost estimates for this alternative account for the necessary investments	This alternative would alleviate the specified problems but would introduce the arsenic issue.	The lifecycle cost for this alternative in 1997 dollars was $282 million which is greater than the Tiber Reservoir-Conventional Treatment of $248 million in 1997 dollars.	This alternative is not acceptable to the Tribe per a tribal resolution. This would require a permit from the State to degrade a water body due to the introduction of arsenic from the Missouri River.	
Missouri Only - Special Treatment	10	10	3	8	31
	Cost estimates for this alternative account for the necessary investments	This alternative would alleviate the specified problems.	The lifecycle cost for this alternative in 1997 dollars was $349 million which is greater than the Tiber Reservoir-Conventional Treatment of $248 million in 1997 dollars.	This alterative may alleviate the arsenic concerns of the State but not the Tribe.	
Milk River	8	8	10	2	28
	Cost estimates for this alternative account for the necessary investments	This alternative would alleviate the specified problems but would introduce the Milk River water supply issue.	The lifecycle cost for this alternative in 1997 dollars was $223 million which is less than the Tiber Reservoir-Conventional Treatment of $248 million in 1997 dollars.	This alternative is not acceptable to the Tribe and other water users of the Milk River due to the shortage of water in the basin, unresolved Tribal water rights, treaties, with Canada, and the poor condition of the St. Marys project	

3.3 MUNICIPAL AND INDUSTRIAL (M&I) EVALUATION PROCEDURE

The P&Gs provide specific evaluation procedures for determining National Economic Development (NED) benefits for Municipal and Industrial Water Supplies[1].

3.3.1 Identification of the Study Area

The study area is the counties of Chouteau, Glacier, Hill, Liberty, Pondera, Teton, and Toole and the Chippewa Cree Indian Reservation in Montana. Figure 1-1 shows the project area and Section 2.4 lists the municipal and rural water systems that are included in the study area.

3.3.2 Future M&I Water Supplies

The sources of M&I water expected to be available to the project area include:

- Existing groundwater sources currently being used by the water users in the project area.
- Existing surface water source of Lake Elwell (Tiber) on the Marias River
- Potential surface water source of the Missouri River.

From the analysis of the previous studies by the sponsors, the groundwater from the currently used alluvium is unlikely to be of sufficient quantity to supply the needs of a regional water system and the treatment for water quality concerns would be a factor. Tiber Reservoir and the Missouri River will be able to provide the quantity of water required by the project area into the future at any time period and for all sectors. Water quality from the Missouri River brings in the arsenic issue which will require more treatment to meet the quality of the Tiber Reservoir.

3.3.3 Future M&I Water Use

Section 5.2 describes the future M&I water demands in the project area and Table 5-3 shows the future demand of the Rocky Boys Reservation and the off-Reservation users of the project.

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[1] U.S. Water Resources Council (1983). Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. Section II, Subsection 2.2.4.

3.3.4 Deficit Between Future Water Supplies and Use

The deficit occurs with the quantity and quality of the groundwater into the future and the quality of the Missouri River.

The water supply sources that the project sponsors are currently using will continue to provide the quantity of water needed in the future with the possible exception of some groundwater locations and the intakes into the surface water sources. The surface water sources of Tiber and the Missouri can provide the quantity of water to meet the future demands.

3.3.5 Alternative Without Federal Plan

Without the Federal Plan, the project sponsors would likely install additional treatment processes to comply with the Safe Drinking Water Act requirements and develop additional water sources. The project sponsors examined an alternative that has each of the off-reservation water systems installing treatment plants at each of their locations. The Reservation would develop a reservation-only system. From the May 2000 report, with each individual water system constructing a treatment facility and the Reservation constructing their own water treatment facilities, the life-cycle cost of this alternative was estimated to be $257,000,000 in 1997.

3.3.6 Ranking of Alternative Plans based on Least Cost

Costs for the Missouri Only – Special Treatment and the Alternative Without Federal Plan were developed in the 1997 Report. These costs included the construction costs and the annualized OM&R costs. The Tiber Only – Conventional Treatment cost are contained in this Final Engineering Report. These also show the construction cost and the annualized OM&R cost. The No-Action alternative has no costs associated with it.

To compare costs, the 1997 costs for both construction and OM&R were indexed to 2002 by a 3 percent annual inflation factor. Also, costs for Interest During Construction (IDC) were estimated. The construction period for the regional water systems was estimated to be 10 years. The construction period for the Alternative Without Federal Project Plan was estimated to be 2 years based on all entities starting at the same time to construct their individual facilities.

The resulting costs are summarized in Table 3-3.

TABLE 3-3
RANKING OF ALTERNATIVE PLANS

	MISSOURI ONLY - SPECIAL TREATMENT	TIBER ONLY-CONVENTIONAL TREATMENT[1/]	ALTERNATIVE WITHOUT FEDERAL PLAN
Project Cost (2002 dollars)	$257,242,917	$218,005,008	$145,535,259
Interest During Construction (IDC) (5 year period)[2/3/]	$25,001,182	$20,492,471	
Interest During Construction (IDC) (2 year period)[2/]			$4,400,695
Annualized OM&R Cost (2002 dollars)	$127,584,000	$64,514,801	$127,423,758
Total Life Cycle Cost W/IDC (2002 dollars)[2/]	$408,182,002	$303,012,280	$277,359,712

[1/] Includes Cut Bank and Kevin not included in Missouri only and without Federal plan

[2/] IDC only included in P&G analysis and not included in other sections of report

[3/] Five years used because water delivery starts in year 5

The resulting ranking from highest cost to least cost alternative:

- Missouri Only - Special Treatment - $408,182,002
- Tiber Only - Conventional Treatment - $303,012,280
- Alternative Without Federal Plan - $277,359,712

3.3.7 Identification of the Most Likely Alternative

The Tiber Only - Conventional Treatment Alternative has been identified as the most likely alternative to be implemented with the least cost. The Alternative Without Federal Plan was not selected for the following reasons:

- For comparison purposes it was estimated that the individual systems would all obtain financing from other sources and construct the treatment plants in a two year timeframe. It is more likely that some of the systems will pursue new treatment and some will continue to use their existing systems. This would not efficiently meet the water needs of the service area due to the cost of meeting new regulations and the continued use of existing systems.
- The needs of the service area and the entities involved is to ensure a safe and reliable water delivery system. A single treatment plant would be more likely to respond in a timely manner to the changing Safe Drinking Water Act regulations than each individual system.
- A regional water system with a dependable water source would eliminate the need to maintain and depend on the number of different water sources of the individual systems.

TABLE 3-4
ENVIRONMENTAL QUALITY ACCOUNT

Alternative	Fish and Wildlife	Noise	Esthetic Value	Cultural Resources	Wetlands and Aquatic Habitat	Floodplains	Grasslands	Wild and Scenic River	Prime Farmland	Water Quality	Air Quality	Endangered Species
Alternatives Analyzed in Feasibility Study												
A. Tiber Only – Conventional Treatment	(-) Temporary impact to fish and wildlife due to intake, treatment plant, and pipeline construction.	(-) Long-term increase in noise near the intake and treatment plant	(-) Decrease in esthetic values near the treatment plant	Effects are unknown at this time	(-) Temporary impact to wetlands, if not avoidable, and aquatic habitat due to intake, treatment plant, and pipeline construction (-) Temporary impacts at stream crossings if not avoidable.	No impact	(-) Temporary impact to grasslands due to intake, treatment plant, and pipeline construction.	(-) Reduction in the volume of diluting water for arsenic into the Missouri River	(-) Temporary impact to Farmland due to pipeline construction	(-) Temporary impact to water quality in the river due to construction activities. (-) Decrease in the volume of diluting water for arsenic into the Missouri River.	(-) Impact from fugitive dust and equipment emissions during construction	(-) Reduction in the amount of water flowing into the Missouri River
B. Missouri Only – Special Treatment	(-) Same as A	(-) Same as A	(-) Same as A	Same as A	(-) Same as A (-) Temporary impact in river to aquatic habitat due to construction activities.	Same as A	(-) Same as A	(-) Decrease in esthetic value near facilities	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A
C. Missouri Only – Conventional Treatment	(-) Same as A	(-) Same as A	(-) Same as A	Same as A	(-) Same as A (-) Temporary impact in river to aquatic habitat due to construction activities.	Same as A	(-) Same as A	(-) Decrease in esthetic value near facilities	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A
D. Milk River	(-) Could be greater than A because of type of intake.	(-) Same as A	(-) Same as A	Same as A	(-) Same as A (-) Temporary impact in river to aquatic habitat due to construction activities.	Same as A	(-) Same as A	No Impact	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A
E. Marias River	(-) Same as A	(-) Same as A	(-) Same as A	Same as A	(-) Same as A (-) Temporary impact in river to aquatic habitat due to construction activities.	Same as A	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A
F. Without Federal Plan	(-) Same as A	(-) Same as A	(-) Same as A	Same as A	(-) Same as A	Same as A	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A

Alternative	Fish and Wildlife	Noise	Water Quality	Air Quality	Endangered Species
A. Tiber Only – Conventional Treatment	(-) Temporary impact to fish and wildlife due to intake, treatment plant, and pipeline construction.	(-) Long-term increase in noise near the intake and treatment plant	(-) Temporary impact to water quality in the river due to construction activities. (-) Decrease in the volume of diluting water for arsenic into the Missouri River.	(-) Impact from fugitive dust and equipment emissions during construction.	(-) Reduction in the amount of water flowing into the Missouri River.
B. Missouri Only – Special Treatment	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A
[illegible]	[illegible]	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A
D. Milk River	(-) Could be greater than A because of type of intake.	(-) Sa[illegible]	[illegible]	[illegible]	[illegible]
E. Marias River	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A
F. Without Federal Plan	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A	(-) Same as A

TABLE 3-5
OTHER SOCIAL EFFECTS

Alternative	Community and Regional Growth	Leisure Opportunities	Residences, Businesses, and Farms	Property Values	Other Income
Alternatives Analyzed in Feasibility Study					
A. Tiber Only– Conventional Treatment	(+) Growth will continue on the Reservation at projected rates.	(+) Significant increase in the opportunities to develop in door leisure and recreational facilities due to lack of good quality drinking water.	(+) Significant improvement in the drinking water quality to the residences, businesses, and farmsteads.	(+) Significant increase in property values due to improved drinking water and availability.	(+) Possible significant increase in the income of the residents of the Reservation from economic development.
B. Missouri Only – Special Treatment	(+) Same as A	(+) Same as A	(+) Same as A	(+) Same as A	(+) Same as A
C. Missouri Only –Conventional Treatment	(+) Same as A	(+) Same as A	(+) Same as A	(+) Same as A	(+) Same as A
D. Milk River	(+) Same as A	(+) Same as A	(+) Same as A	(+) Same as A	(+) Same as A
E. Marias River	(+) Same as A	(+) Same as A	(+) Same as A	(+) Same as A	(+) Same as A
F. Alternative Without Federal Plan	(+) Same as A	(+) Same as A	(+) Same as A	(+) Same as A	(+) Same as A

4. DEMOGRAPHICS

4.1 HISTORIC POPULATION AND GROWTH RATES OF PROJECT AREA

Table 4-1 presents the historic population by County for both Indian and non-Indian population within the project area. Table 4-1 includes all populations of Chouteau, Glacier, Hill, Liberty, Pondera, Teton, and Toole Counties. Sources of data are the censuses of the United States from 1920 through 2000.

These figures in Table 4-1 include the total population within each county. The service area of this project only includes a portion of these counties. Additionally, these population figures do include the Rocky Boy's Reservation (part of Hill and Chouteau Counties). This data indicates that the total population in the study area is increasing.

4.2 MONTANA INDIAN POPULATION AND GROWTH RATES

Table 4-2 summarizes the Indian population for the state of Montana during the century from 1890 through 1990. Indian population in the state ranged from a low of 10,745 in 1910 to a high of 47,524 in 1990. From 1960 through 1990, the state-wide Indian annual growth rate was 2.7%. Therefore, a future annual growth rate of 3.0% on the Rocky Boy's Indian Reservation was selected.

4.3 PROJECT POPULATION PROJECTION FROM 2000 CENSUS

Table 4-3 presents the 2000 census population data, the projected growth rates, and the design populations. The projected growth rates were developed in the report "Rocky Boy's/North Central Montana Regional Water Supply System, Off-Reservation Needs Assessment " (DNRC, 1996) and were subsequently modified based on information gathered by Montana Rural Water Systems, Inc. (April 1, 2003) (Appendix I). The resultant design year population projections were then used to determine the design water requirements that the North Central System must deliver.

TABLE 4-1
CENSUS COUNTS, NORTH CENTRAL MONTANA COUNTIES

Year	Chouteau	Glacier	Hill	Liberty	Pondera	Teton	Toole	Total	Percent Change
1920	11,051	4,178	13,958	2,416	5,471	5,870	3,724	**48,588**	
1930	8,635	5,297	13,775	2,198	6,964	6,068	6,714	**51,581**	**6.16%**
1940	7,316	9,034	13,304	2,209	6,716	6,922	6,769	**54,210**	**5.10%**
1950	6,974	9,645	14,285	2,180	6,392	7,232	6,867	**55,525**	**2.43%**
1960	7,348	11,565	18,653	2,624	7,653	7,295	7,904	**65,002**	**17.07%**
1970	6,473	10,783	17,358	2,359	6,611	6,116	5,839	**57,509**	**-11.53%**
1980	6,092	10,628	17,985	2,329	6,731	6,491	5,559	**57,795**	**0.50%**
1990	5,452	12,121	17,654	2,295	6,433	6,271	5,046	**57,262**	**-0.92%**
2000	5,970	13,247	16,673	2,158	6,424	6,445	5,267	**58,184**	**1.61%**
Overall Total (from 1920 - 2000)									**19.75%**

TABLE 4-2
POPULATION AND GROWTH RATE OF MONTANA INDIANS

Year	Population	10-Year	20-Year	30-Year	50-Year
1890	11,206	--	--	--	--
1900	11,343	.1	--	--	--
1910	10,745	-.5	-.2	--	--
1920	10,956	.2	-.2	-.1	--
1930	14,798	3.1	1.6	.9	--
1940	16,841	1.3	2.2	1.5	.8
1950	16,606	-.1	.6	1.4	.8
1960	21,181	2.5	1.2	1.2	1.4
1970	27,130	2.5	2.5	1.6	1.8
1980	37,153	3.2	2.8	2.7	1.9
1990	47,524	2.5	2.8	2.7	2.1

Source: U.S. Census Bureau

Table 4-3
Population Projections

Location	2000 Population[(1)]	50-Year Design Pop. Growth (%)[(2)]	50-Year Design Population[(3)]
Dutton	389	4.7%	407
Hill CWD	2,100	11.0%	2,331
N.Havre	130	12.1%	146
Sage Creek	250	8.4%	271
Sage Creek Col.	119	0.0%	119
Tiber	1,000	5.2%	1,052
Big Sandy	703	6.6%	749
Chester Treated	871	21.2%	1,056
Chester Untreated	0	0.0%	0
Conrad	2,753	22.7%	3,379
Devon	70	7.5%	75
Eagle Cr. Col.	119	0.0%	119
Galata	275	5.7%	291
Loma Rural	170	9.9%	187
Loma Town	92	9.8%	101
Oilmont Rural	400	10.5%	442
Oilmont Town	0	10.5%	0
Riverview Col.	119	0.0%	119
S.Chester	78	5.4%	82
Shelby	3,216	22.2%	3,929
Sunburst	415	6.6%	442
Sweetgrass	100	5.2%	105
Kevin	178	10.0%	196
Cut Bank	3,105	22.2%	3,794
Subtotal	**16,652**	**16.5%**	**19,393**
Rocky Boy's	3,478		12,000
Total	**20,130**		**31,393**

(1) U.S. Census Bureau 2000

(2) Grow rates based on data collected under state funding study by Aquoneering in 1997.

(3) 50-year design population based on 2000 population and 50-year design population growth.

4.4 HISTORIC WATER DEMANDS

The historic water demands for each of the communities and water districts is shown in Table 4-4. The average day and peak day demands are shown for all of the entities and shows a large variance in the peak day factor (peak day demand divided by the average day demand). This variance indicates that the water use pattern of each of the entities varies significantly between 1.47 and 5.8. These differences are attributable to the amount of lawn watering, amount of leakage, implementation of water conservation measures, use of water meters for billing, and water rates. Similarly, the per capita water demands for these entities varies significantly for the reasons indicated above.

Projections were made for the project over a 50-year period beginning in 2000 and ending in 2050. The regional drinking water project proposed in PL 107-331 will have a functional life that will extend well beyond a 50-year period and well beyond the year 2050. Design was based on population in the year 2050, for several reasons. First, a 50-year period was considered reasonable as an economical life of project for evaluation of the future stream of Operation, Maintenance and Replacement (OM&R) costs in the sizing of pipelines, pumping stations and the water treatment plant. Second, projection over more than a 50-year period represents high-risk estimating. An investment of greater federal, state and local funds in the project for a level of population projected beyond year 2050 was not considered sound due to uncertainties as discussed above. Water conservation gains are realistic over the next three decades to permit an increase in population beyond year 2050 if greater population is realized. Due to current uncertainties, water treatment plant expansion and construction of additional pipeline capacity can be planned with more cost-effectiveness when a population greater than projected for 2050 and full potential for future water conservation have been realized. With future knowledge, better decisions can be made with regard to the location and amounts of increased demand than can be made currently.

TABLE 4-4
HISTORIC WATER DEMANDS

	Demands[4]			Population Demographics		
Location	Average Day Demand (gpd)[1]	Peak Day Demand (gpd)	Peak Day Factor	2000 Population	Average Per-Capita Usage (gpcpd)	Household Meter Use (gpd)
Dutton	60,500	150,000	2.48	389	156	267
Hill CWD	262,500	470,000	1.79	2100	125	328
N.Havre	35,000	75,000	2.14	130	269	636
Sage Creek	51,652	108,000	2.09	250	207	646
Sage Creek Col.[2]	14,875	40,000	2.69	119	125	402
Tiber	150,000	600,000	4.00	1000	150	429
Big Sandy	200,000	750,000	3.75	703	284	541
Chester	300,000	1,000,000	3.33	871	344	632
Conrad	344,125	2,000,000	5.81	2753	125	280
Devon	24,000	75,000	3.13	70	343	1043
Eagle Cr. Col.[2]	14,875	40,000	2.69	119	125	402
Galata	150,000	220,000	1.47	275	545	1364
Loma Rural	81,000	162,000	2.00	170	476	1125
Loma Town	54,395	198,000	3.64	92	591	989
Oilmont Rural	80,000	216,000	2.70	400	200	1000
Oilmont Town	10,000	25,000	2.50	Included in Oilmount Rural		
Riverview Col.[2]	14,875	40,000	2.69	119	125	402
S.Chester	38,000	142,000	3.74	78	487	1188
Shelby	450,000	1,800,000	4.00	3216	140	336
Sunburst	110,000	420,000	3.82	415	265	815
Sweetgrass	32,500	150,000	4.62	100	325	591
Kevin	41,000	125,000	3.05	178	230	410
Cut Bank	775,000	2,168,000	2.80	3105	250	599
Subtotal	**3,294,297**	**10,974,000**	**3.33**	**16,652**	**198**	**588**
Rocky Boy's[3]	1,920,000	4,880,000	2.54	N/A	N/A	N/A
Total	**5,214,297**	**15,854,000**	**3.04**	**N/A**	**N/A**	**N/A**

Assumptions:

1 All Average Day per Capita Use below 125 gpcpd are assumed to be 125 gpcpd

2 Colony population and water use was estimated by Montana Rural Water personnel

3 No historical data available for Rocky Boy's Reservation. Demands listed in table are from Table 4-2.

4 Includes municipal, rural, industrial, and stockwater demands.

5. DESIGN CRITERIA

5.1 SUMMARY OF DESIGN CRITERIA

The criteria for design are in two main categories including water demands and the physical parameters associated with sizing a water system. These criteria are shown in Table 5-1 and are broken down into these categories. The water demand criteria will set the capacity that must be provided by the improvements. The water demands will be important in sizing the raw water intake, water treatment plant, storage, pumping stations, and pipelines. The physical parameters criteria will also dictate the size of the major components of the proposed water system. These criteria were set to size the pumping and transmission system within the ranges typically found in water systems. The design criteria for the raw water intake and the water treatment plant will be identified in Chapter 6 on water treatment.

TABLE 5-1
DESIGN CRITERIA FOR THE FINAL ENGINEERING REPORT

VARIABLE	CRITERIA
Water Demand	
Design Period	50 Years
Design Flow	Peak Day Domestic Demands + Livestock + Losses
Peak Day Peaking Factor	2.5 for Reservation; 2.7 for communities using the minimum per capita use rate. Other communities use peak rates as established by the demands from the Needs Assessment.
Transmission System Losses	10% of Average Domestic and Livestock Demand for the North Central Transmission System (both core and non-core)
On-Reservation Distribution System Losses	15% of Average Domestic Demand for the On-reservation Distribution System
Existing Off-Reservation Distribution System Losses	Included in historic and projected water demands for existing off-reservation systems
Physical Parameters	
-max velocity	5 fps (2-4 fps typical) (Velocity is a guideline only. Headloss ultimately governs.)
-minimum pressure	35 psi
-maximum pressure	200 psi (Where topography makes this value unpractical, higher strength pipe is used)
-sizing	Pipelines sized for peak day domestic demand plus livestock demand and losses. Peak hour and fire flows are not provided by the transmission mains. The local distribution system and storage is intended to provide these flows.
-Hazen-Williams C-Factor	Cement Mortar Lined Ductile Iron or Steel C=130, PVC C=140
Intake, WTP and Pump Station Sizing	These components are sized for peak day domestic demand plus livestock demand and losses.
Water Delivery Period	24 hours

5.2 WATER USE DESIGN CRITERIA

This section summarizes the methodology utilized to compute the future water demands. The methodology described was that approved by Congress in the project authorization and included in the May 2000 Planning/Environmental Report prepared by MSE-HKM.

Table 5-1 summarizes the application of the sizing criteria throughout the regional project based on a *design* population, average daily water use, and a maximum daily water use employing a factor of 2.5 times the average on the Reservation, 2.7 times the average for the non-core communities with historic water use below 125 gpcpd, and historic peak factors for the remaining non-core community. The design population within the Rocky Boy's Indian Reservation was projected in Chapter 4, along with the non-core population (Table 4-3).

5.2.1 Reservation Water Needs

Future water needs were estimated based on the information developed for and presented in previous studies. The Appraisal Study compares the estimated 1997 Rocky Boy Reservation public water supply per capita rate of use (estimated between 84 and 103 gallons per capita per day) with national (179 gpcpd), state (222 gpcpd), Chouteau County (324 gpcpd) and Hill County (116 gpcpd) rates of use for public water supply systems developed by the USGS for 1995. For this study a value of 160 gpcpd was used. This rate of use would accommodate increases in domestic, institutional, and commercial usage consistent with a regional, state, and national rates of use after conservation measures have been applied. Multiplying the projected population by the 160 gpcpd rate of use results in an estimate of projected water needs. Public uses and losses of 15 percent was used for the reservation water distribution system and were applied to the domestic water demand based on 160 gpcd.

The Tribe is concerned with increasing population density in the upland area and has stated that future growth will be concentrated in the area bounded by Box Elder on the southwest, Sangrey on the east and Laredo on the north. This growth pattern has been used to distribute the future population and water demands within the service area. Table 5-2 shows the future population and water demand on the Reservation used for this study.

TABLE 5-2
FUTURE RESERVATION DEMANDS

		Average Day			Peak Day[1]	
Area	**People**	**GPD**	**GPM**	**AFY**	**GPD**	**GPM**
Rocky Boy Agency	1,100	176,000	122	197	440,000	306
Agency Road Area	300	48,000	33	54	120,000	83
Azure	400	64,000	44	72	160,000	111
Bonneauville	500	80,000	56	90	200,000	139
NW From Sangrey	100	16,000	11	18	40,000	28
Sangrey/Buttercup	570	91,200	63	102	228,000	158
Post Plant Road	30	4,800	3	5	12,000	8
Box Elder Village	200	32,000	22	36	80,000	56
Lower Dryfork	1,000	160,000	111	179	400,000	278
Box Elder Township	225	36,000	25	40	90,000	63
Lower Road Scattered	275	44,000	31	49	110,000	76
Beaver Creek Extension	100	16,000	11	18	40,000	28
Upper Duck Creek Road	150	24,000	17	27	60,000	42
Lower Duck Creek Road	50	8,000	6	9	20,000	14
Camp Creek Area	100	16,000	11	18	40,000	28
Eagleman Area	300	48,000	33	54	120,000	83
Haystack Loop	300	48,000	33	54	120,000	83
Laredo	900	144,000	100	161	360,000	250
Hwy 87 - Laredo	2,550	408,000	283	457	1,020,000	708
Laredo Road - SE	1,250	200,000	139	224	500,000	347
Parker Canyon	400	64,000	44	72	160,000	111
Parker School	400	64,000	44	72	160,000	111
Newtown/Pastime	400	64,000	44	72	160,000	111
St. Pierre Ridge Road	200	32,000	22	36	80,000	56
Williamson Range	200	32,000	22	36	80,000	56
Subtotal	12,000	1,920,000	1,330	2152	4,800,000	3,333
Stockwater[2]		40,000	28	45	64,000	44
Subtotal		1,960,000	1,358	2197	4,864,000	3,378
15% Distribution System Losses		294,000	204	329	294,000	204
Subtotal		2,254,000	1,562	2526	5,158,000	3,582
Transmission System Losses		225,000	159	251	225,000	156
Total[3]		2,479,000	172	2,777	5,383,000	3,738

[1] The peak day is the day during the year with the highest demand. For this study the peak day is 2.5 times the average day. This factor is not applied to public use and losses.

[2] Peaking factor for Stockwater is 1.6 times the average day.

[3] Does not include operational requirements.

While the 160 gpcpd includes water needed for meeting domestic, industrial and commercial uses, it does not include water required for stockwatering. About 50 people on the Reservation derive income from raising cattle. To accommodate this component of the private sector economy, it is also planned to deliver water for 4,000 animal units (AU). An average day rate of use of 10 gallons per AU was used for this project. That rate of use will be retained for this study. A peak day rate of use at 16 gallons per AU has been used. Total average day stockwatering demands are estimated at 40,000 gallons and peak day demands at 64,000 gallons.

5.2.2 Off-Reservation Water Needs

Average daily per capita water requirements varied by community, based on information provided by them. If a community's historic average daily per capita water consumption (Table 4-4) was greater than 125 gpcd, the historic value was used in the future water need calculations. If a community's average daily per capita water requirement was less than 125 gpcd, a value of 125 gpcd was used in calculations. The average daily per capita water requirement used for the Reservation was 160 gpcd. An additional livestock demand of 10 gallons per animal unit per day average was applied. The total number of livestock served by this system is 26,719 AU. Table 5-3 presents the projected water demands for this project. Design for maximum day is based on application of a factor of 2.7 or historic factors for community and rural demands, a factor of 2.5 for the Reservation, a factor of 1.6 for livestock use, and 10 percent transmission system loss. Demands were based on a 24-hour day.

All major project facilities in the regional water project were sized to meet maximum day requirements. The facilities that would be sized for maximum day demands include the intake, treatment plant, and main transmission lines. Maximum day is defined as the 24-hour period during the year when water requirements are the greatest. The maximum day generally occurs in July or August when lawn sprinkling, gardening and in-house uses are at their peak. Facilities that would be sized for maximum day demand include the main transmission pipelines and pumping stations, as well as valves, meters and other appurtenances.

5.3 PHYSICAL PARAMETER DESIGN CRITERIA

This section of the report will identify the physical design criteria to analyze and size the transmission, storage, and pumping system to deliver water to the member communities and water districts and the Reservation. As stated previously, the raw water intake and water treatment plant criteria and goals will be discussed in Chapter 6. Table 5-1 includes a summary of these criteria that were used to size the components of this system.

TABLE 5-3 NORTH CENTRAL SYSTEM COMMUNITY DEMANDS

	Projected Community Information		Other Anticipated Demands		Design Life Demands		Total Demands w/Losses			
Design Year Demands										
Location	Population Growth (%)	End of Life Average Day Demand (gpd)1	Other Average Day Demands (gpd)2,3	Other Peak Day Demands (gpd)2,3	Design Life Average Day Demands (gpd)	Design Life Peak Day Demands (gpd)	10% Transmission System Losses (gpd)	Adjusted Average Day Demand (gpd)	Adjusted Peak Day Demands (gpd)	Adjusted Peaking Factor
Dutton	4.7%	63,300	11,600	19,000	74,900	176,000	7,490	82,390	183,490	2.23
Hill CWD	11.0%	291,000	45,800	92,500	336,800	613,500	33,680	370,480	647,180	1.75
N.Havre	12.1%	39,200	22,900	31,900	62,100	115,900	6,210	68,310	122,110	1.79
Sage Creek	8.4%	56,000	37,000	55,000	93,000	172,000	9,300	102,300	181,300	1.77
Sage Creek Col.	0.0%	14,900	0	0	14,900	40,100	1,490	16,390	41,590	2.54
Tiber	5.2%	158,000	170,000	233,000	328,000	865,000	32,800	360,800	897,800	2.49
Big Sandy	6.6%	213,000	10,900	11,400	223,900	810,400	22,390	246,290	832,790	3.38
Chester	21.2%	364,000	15,800	10,900	379,800	1,220,900	37,980	417,780	1,258,880	3.01
Conrad	22.7%	422,000	118,000	208,000	540,000	2,658,000	54,000	594,000	2,712,000	4.57
Devon	7.5%	25,800	45,400	68,800	71,200	149,400	7,120	78,320	156,520	2.00
Eagle Cr. Col.	0.0%	14,900	0	0	14,900	40,100	1,490	16,390	41,590	2.54
Galata	5.7%	159,000	114,000	51,900	273,000	284,900	27,300	300,300	312,200	1.04
Loma Rural	9.9%	89,000	63,900	24,600	152,900	202,600	15,290	168,190	217,890	1.30
Loma Town	9.8%	59,700	0	0	59,700	217,000	5,970	65,670	222,970	3.40
Oilmont Rural	10.5%	88,400	77,300	60,900	165,700	299,900	16,570	182,270	316,470	1.74
Oilmont Town	10.5%	11,000	0	0	11,000	27,500	1,100	12,100	28,600	2.36
Riverview Col.	0.0%	14,900	0	0	14,900	40,100	1,490	16,390	41,590	2.54
S.Chester	5.4%	40,000	35,000	28,500	75,000	177,500	7,500	82,500	185,000	2.24
Shelby	22.2%	550,000	324,000	399,000	874,000	2,599,000	87,400	961,400	2,686,400	2.79
Sunburst	6.6%	117,000	18,400	5,310	135,400	452,310	13,540	148,940	465,850	3.13
Sweetgrass	5.2%	34,200	5,590	5,050	39,790	163,050	3,979	43,769	167,029	3.82
Kevin	10.0%	45,100	5,000	8,000	50,100	146,000	5,010	55,110	151,010	2.74
Cut Bank	22.2%	947,000	0	0	947,000	2,652,000	94,700	1,041,700	2,746,700	2.64
Subtotal	16.5%	**3,820,000**	**1,120,000**	**1,310,000**	**4,940,000**	**14,100,000**	**494,000**	**5,430,000**	**14,600,000**	2.69
Rocky Boy's	N/A	2,254,000	0	0	2,254,000	5,158,000	225,000	2,479,000	5,383,000	2.17
Total	N/A	**6,070,000**	**1,120,000**	**1,310,000**	**7,190,000**	**19,300,000**	**719,000**	**7,910,000**	**20,000,000**	2.53

Notes

1 End of Life Average Day Demand is equal to the population growth multiplied by the current Average Day Demand
2 Additional Anticipated Demands includes new users and individual requests, livestock use, and future commercial, and industrial demands
3 Demands are assumed to be equal to the demands identified in the Environmental Report
4 See Appendix H for expanded calculation table
5 Total raw water delivery will need to be 5 percent greater than total peak day demand to account for in-plant uses

The water demand information and the physical design parameters were used in conjunction with a water distribution system model to layout and size the delivery system to provide the anticipated quantities of water to the respective communities and water districts. The water distribution system model utilized was the PIPE 2000 computer model. Once set up, this model can complete the thousands of calculations required to compute the flows, head losses, and pressures required to accurately analyze a water transmission system.

The configuration of the non-core system is such that it should be considered a water transmission system rather than a distribution system. The distinction is that the system will deliver large quantities of treated water to already established communities and water districts. Each of these communities and water districts then actually distributes the water to their respective customers. The communities and water districts will have the responsibility to provide peaking storage (difference between peak hour and peak day demands), will provide actual connections to each of their customers, and will bill their customers for the water consumed. The North Central Water System will meter and bill each of these communities and water districts for the total amount of water metered at the point of connection. Each community and water district will be responsible for the operation, maintenance, and replacement of their respective distribution system from the point of connection to the North Central Water System.

Since each community has its own peaking storage, the North Central water system was not sized to provide fire flows. The reservation system was sized to provide fire flows and is discussed further in Section 5.3.5.

5.3.1 Pressures

The transmission system will be sized to provide a minimum pressure of 35 psi at any point in the system. System pressure (or dynamic hydraulic grade line) is defined as the difference between the final hydraulic grade line and the elevation of the ground surface at that location. The 35 psi minimum limit will be accomplished by providing pipelines with adequate size and pumping stations with adequate pressures to develop this minimum pressure. The system was modeled using the PIPE 2000 water distribution system modeling software to size the pipelines and pumping stations.

Since each individual community and water district will be providing the peaking storage for their respective systems, the North Central Water System will need to provide only the peak day demand at the pressures indicated. This feature of the system will reduce the cost of the entire system since many of the communities and water districts already have adequate amounts of peaking storage.

The maximum pressure in the system will be limited for the most part to under 200 psi. This limitation will minimize the use of high pressure pipeline materials such as steel and will tend to reduce the overall energy requirements. In some limited cases where there is a need for multiple pumping stations in a series, the 200 psi maximum limit may be exceeded to eliminate a pumping station. Not only would this deviation eliminate the construction cost of the pumping station, it would also eliminate the ongoing operation, maintenance, and replacement costs associated with a pumping station.

5.3.2 Transmission Pipelines

Generally, pipelines will be sized to minimize the velocity to under 5 fps with 2-4 fps being more typical velocities. Ultimately, however, the pipelines must be sized to maintain the minimum pressure identified as the design parameter. Frictional losses were computed by the PIPE2000 model using the *Hazen-Williams* equation. Friction coefficients are assigned to the pipelines based on the pipe materials. For this analysis, the *Hazen-Williams* coefficients used were 140 for PVC pipe and 130 for DIP and cement mortar lined steel. Material selection for pipelines will be discussed in Chapter 7 and will be a function of size and pressure.

5.3.3 Pumping Stations

Pumping stations will be sized to provide the required flows with one pump out of service to meet Montana Department of Environmental Quality (DEQ) standards. These pumping stations will be designed to include standby power, in case of a localized power outage, and will have suitable control systems to operate the pumps based on storage tank levels or on pressure. Operation from the levels in a storage tank will be preferred, however, depending on the strategic locations for storage operation utilizing pressures may be required in some instances. In all cases, the pump stations will be tied back to the central operating site (at the water treatment plant) using an integrated telemetry system.

5.3.4 Storage

With each community and water district providing their own peaking storage, the need for storage in the transmission system is somewhat diminished. It will be important to provide some amount of storage for the following reasons:

- Provide stored water so that the occasional water main break can be repaired without affecting the delivery of water to the communities and water districts.
- Provide a cushion for the water treatment plant so that production will not have to exactly meet demands. This cushion will allow the treatment plant to operate at a more constant rate, which is desirable from an operation standpoint for the treatment plant.

- Provide a volume of water for the pumping stations to pump to and for the occasional maintenance of the pumping station that would not allow any flows. Operation of the pumps based on levels in the respective storage tanks they pump to will be the most simple way to control these pumps.

For these reasons, the storage will be sized to provide one-half of the design year average day demand. This storage will be strategically located to match the demands from the communities and water districts that are served. Additionally, these storage tanks will be located so that each major pumping station is adjacent to a storage tank and will be controlled by the level in the storage tank. The smaller pump stations may not be located adjacent to a storage tank and therefore, these stations will have to be controlled using system pressures.

5.3.5 Reservation Transmission System Sizing

The sizing criteria for the reservation system was similar to the sizing criteria for the overall system with the exceptions that the system was sized to meet peak hour demands and to provide for fire flows. Since the reservation system will deliver flows to the reservation communities and to numerous end users along the pipeline route, this system must be designed and operate just as one of the other existing communities connected to the system. Each of the other communities has its own peaking storage to meet peak hour flows and fire flows. The North Central system will be designed to provide peak day flows only. Therefore, as with the non-tribal systems, the reservation system must provide storage adequate for peak hour demands and fire flows. The reservation system was designed to include peaking storage and pipeline capacity to meet peak hour demands. This criteria dictated the size of the pipelines as well as the size and distribution of the storage facilities.

Indian Health Service (IHS) does not have design standards for fire flows. The word "fire" occurs only three times in the most recent "Criteria for the Sanitation Facilities Construction Program" (May 1999). The essence of the IHS criterion for fire flows is that fire flows are optional and “IHS can design for fire fighting capability provided there is an organized fire department in the community. However, IHS is not bound by the International Organization for Standards (ISO) *sic (ISO in this context is the acronym for Insurance Services Office)* criteria.”

IHS uses the Sanitation Deficiency System (SDS) as the program to document sanitation system deficiencies. The Tribe has elected to complete this work through a Compact along with all of the IHS programs on the Rocky Boy Reservation and it is not believed that IHS is preparing SDS reports for the Rocky Boy Reservation. Earlier SDS reports were reviewed in the preparation of the Rocky Boy Reservation Municipal, Rural and Industrial Water Supply Appraisal Study (CCT/MSE-HKM, Inc., 1999) and compared to deficiencies found by HKM. The improvements proposed in the FER address the deficiencies.

Storage facilities are necessary throughout the system to meet peak demands and maintain system pressures within a reasonable operating range. Storage is also required to meet fire flows and is important during power outages where booster pumps cannot operate for an extended period.

The storage facilities within the Rocky Boy's transmission system are sized to provide 75 percent of a peak day demand maintained for 24 hours plus a 2 hour fire event of the NFF (Needed Fire Flow). Therefore, at the end of a fire demand event the storage facility should have 25 percent of its capacity remaining.

The Reservation transmission system provides for fire flows at the major population centers. For a typical water system, the NFF is based on the rating established by the Insurance Services Office (ISO). The ISO evaluates the area buildings based on the type of construction, occupancy, exposure and communications based on the separation of building sections by fire doors. The Rocky Boy's transmission system, however, does not currently provide for adequate fire protection and no ISO ratings were available at the time of this report. Therefore, generalized ISO guidelines were utilized to establish a value for the fire flow. For residential dwellings spaced 100 feet or more apart, the NFF is 500 gpm. Dwellings spaced between 31 and 100 feet apart required 750 gpm. The Reservation has tightly spaced housing clusters that would require 750 gpm and larger structures that would likely require greater flows. Thus, a fire flow demand of 1500 gpm was added to peak day demand to evaluate any changes the system would require to meet the demand.

The system was evaluated with the fire flow located at a point of high elevation, high demand or at the far ends of the system where it is most difficult to meet the demand. For this system, the fire demands had minimal effect on the major cost components of the transmission system. Line sizes were not increased and pumps still operate at peak day. Thus, additional storage capacity is the only factor that the fire demands increased. Fire flow storage is provided through the same storage facilities located throughout the transmission system. The fire flow locations included Sangrey, Rocky Boy/Newtown, Laredo and at the highest point of Haystack Loop.

6. WATER SUPPLY AND TREATMENT

6.1 INTRODUCTION

The purpose of this chapter is to outline the preliminary design for the new intake, pump station, and surface water treatment plant, discuss the impact of recently available water quality data and additional alternatives that have been considered, outline existing and proposed drinking water regulations, and describe the facilities currently recommended based on available data. The concluding section will present an estimate of the capital cost of the currently recommended facilities.

The water supply source for the proposed Rocky Boy's/North Central Regional Water System will be Tiber Reservoir (Lake Elwell). An intake and pump station at the reservoir will supply raw water to a water treatment plant located near the reservoir. These facilities will be the sole source of water for the Rocky Boy's/North Central Montana Regional Water System project.

6.2 BASIS OF DESIGN

The proposed intake, pump station, and water treatment plant must meet recognized design standards and the design criteria of the Montana Department of Environmental Quality (DEQ) and the U.S. Environmental Protection Agency (EPA). The facilities' design will meet existing and immediate future applicable regulations and include provisions or a plan to meet future anticipated regulations.

6.2.1 Water Production Requirements

The water supply and treatment facilities will be designed to meet the maximum day demand of the water system. Based on continuous operation, the water production peak flow will be:

50 year peak demand with losses	20.0	mgd
Plant water use (5 percent)	1.0	mgd
Raw water delivery	21.0	mgd

In the Rocky Boy's/North Central Montana Regional Water System Planning/Environmental Report (PER) (HKM, May 2000), the plant was sized for 20-hour per day operation with a treated water delivery flow of 20 mgd. In the Value Engineering (VE) study, the decision was made to change to 24-hour operation to improve treatment efficiency and reduce the size of the water supply and treatment facilities. As a result, the treated water delivery capacity was reduced from 20 mgd to 16.7 mgd, the peak demand with losses indicated in the PER. Since then, the peak demand with losses has been adjusted to 20.0 mgd, due to refinements of the future demand projected for the service area.

6.2.2 Water Treatment Components

The PER, Value Engineering (VE) Report, and Accountability Report for the Rocky Boy's/North Central Montana Regional Water System have narrowed down the recommended intake and treatment system facilities to the components and alternatives indicated below.

6.2.2.1 Water Supply and Treatment Components

Source Water
- Tiber Reservoir

Intake
- Two micro-tunneled intake laterals into reservoir
- Two inclined directional-drilled intake pipes into reservoir (Alternate[1])
- Tunnel to connect to existing reservoir outlet (Alternate[1])

Intake Pump Station
- Caisson with vertical turbine pumps
- Submersible pumps mounted in inclined intake pipes (Alternate[2])

Raw Water Pond
- Eliminated in the value engineering study (only if connecting to existing reservoir outlet alternative is not used)

Pretreatment
- Conventional rapid mix/flocculation/sedimentation
- Conventional rapid mix/flocculation with plate or tube settling (Alternate[3])
- Ballasted Sedimentation (Alternate[3])

Filtration
- Gravity filters
- Microfiltration membranes

[1] These alternatives could be selected if the geotechnical investigation does not favor microtunneling.

[2] This alternative would be used if the inclined lateral intake alternative were used.

[3] Final pretreatment will be based on the treatability of the raw water and the most cost-effective alternative.

On-Site Storage

- 2.0 million gallon clearwell

High Service Pump Station

- Vertical turbine pumps suspended into clearwell

Residuals Handling

- Dewatering lagoons with solids land applied

Chemical Addition

- Chlorine dioxide
- Powdered Activated Carbon (PAC)[4]
- Alum or ferric chloride
- Coagulant polymer
- Filter aid polymer
- Caustic soda[4]
- Fluoride
- Sodium Hypochlorite (chlorine)
- Aqueous Ammonia (ammonia)

6.2.3 Water Quality Goals

Turbidity	Less than 0.1 NTU for filtered water (settled goal < 1.0 NTU)
pH	8.0 minimum
TOC Reduction	35%-50% prior to filtration
Particle Count	Less than 50/ml
THM	60 ug/L Stage 1 and 40 ug/L Stage 2
HAA	45 ug/L Stage 1 and 30 ug/L Stage 2
Log Removals	Greater than 3.0
Manganese	Less than 20 ug/L

Final decisions on alternatives that need additional geotechnical information or water quality data cannot be made until the additional information is obtained during the preliminary design phase. Preliminary water quality data, obtained after the VE study was completed, indicates that the raw water quality from the reservoir has higher levels of turbidity and organics than previously anticipated. As a result, the treatment requirements will be more challenging than previously envisioned, requiring use of a combination of treatment technologies to achieve the water quality goals.

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[4] This alternative is pending additional water quality data and pilot testing. It is not confirmed yet whether or not these chemicals are required.

A preliminary schematic of the proposed intake/pump station and treatment plant facilities, using conventional treatment, is shown in Figure 6-1. The diagram shows the flow scheme from the reservoir, through the plant, and through high service pumping. It also illustrates the solids flow streams, the waste recovery pump station, and the backwash/sludge lagoons.

6.3 RAW WATER QUALITY AND FINISHED WATER GOALS

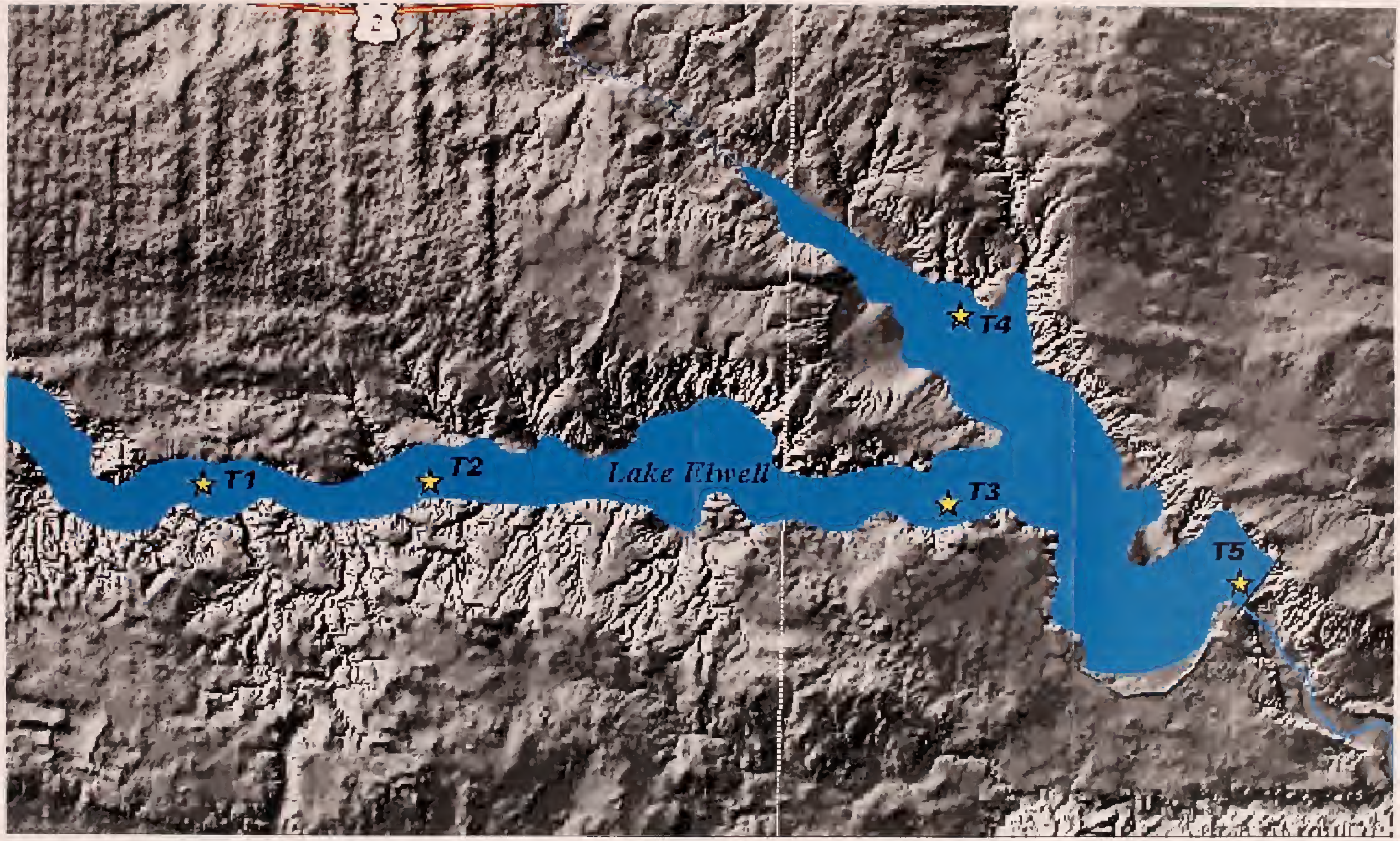
The quality of raw water that must be treated and the regulations that require a specific quality of finished water are primary factors affecting selection of the treatment facilities needed for a given water treatment facility. The following sections describe the water quality data that is currently available and specific regulations affecting the design of the water treatment plant.

6.3.1 Water Quality Data

The Bureau of Reclamation (Reclamation) sampled the Tiber Reservoir water quality monthly from May through October 2002. The Reclamation sampling locations in the reservoir are shown in Figure 6-2. Note that sample Location T5 is closest to the proposed intake location. A sixth sampling point is located near the outlet works on the Marias River but is not included because of limited pertinent available data. Additional USGS National Stream Water Quality data was obtained from the USGS Digital Date Series DDS-37 and is included in Appendix C.

Water quality parameters collected by the Reclamation that are of primary interest include pH, Total Organic Carbon (TOC), and turbidity. The other data that the Reclamation collected include temperature, nutrients, chlorophyll, dissolved oxygen, sulfates, chlorides, and total dissolved solids. The complete data set is included as Appendix C. No data on iron, manganese, alkalinity, coliform, or *Cryptosporidium* concentrations are available from the Reclamation data.

The raw water quality data identified two key parameters, elevated levels of TOC and turbidity, which will affect the water treatment process selected for this project. TOC levels are important because the regulations require removal of a certain percentage of TOC based on the organic content of the raw water. In addition, elevated TOC levels indicate the water may have the potential to develop a high level of Disinfection Byproducts (DBP). The TOC concentrations averaged 4 mg/L, with the highest recorded value of 9.5 mg/L occurring at the location closest to the proposed intake (Sample Location T5). The TOC data from point Location T5 (Reclamation sample point located nearest the proposed intake) is summarized in Table 6-1.



HKM ENGINEERING

HDR Engineering, Inc.

ROCKY BOY'S / NORTH CENTRAL MONTANA
REGIONAL WATER SYSTEM
TIBER LOCATIONS

FIGURE
6-2

P:/Water/OD...3407/Fed Final Figures/Fig 2 map.dgn 09/23/2003 13:05:28 PM MDT

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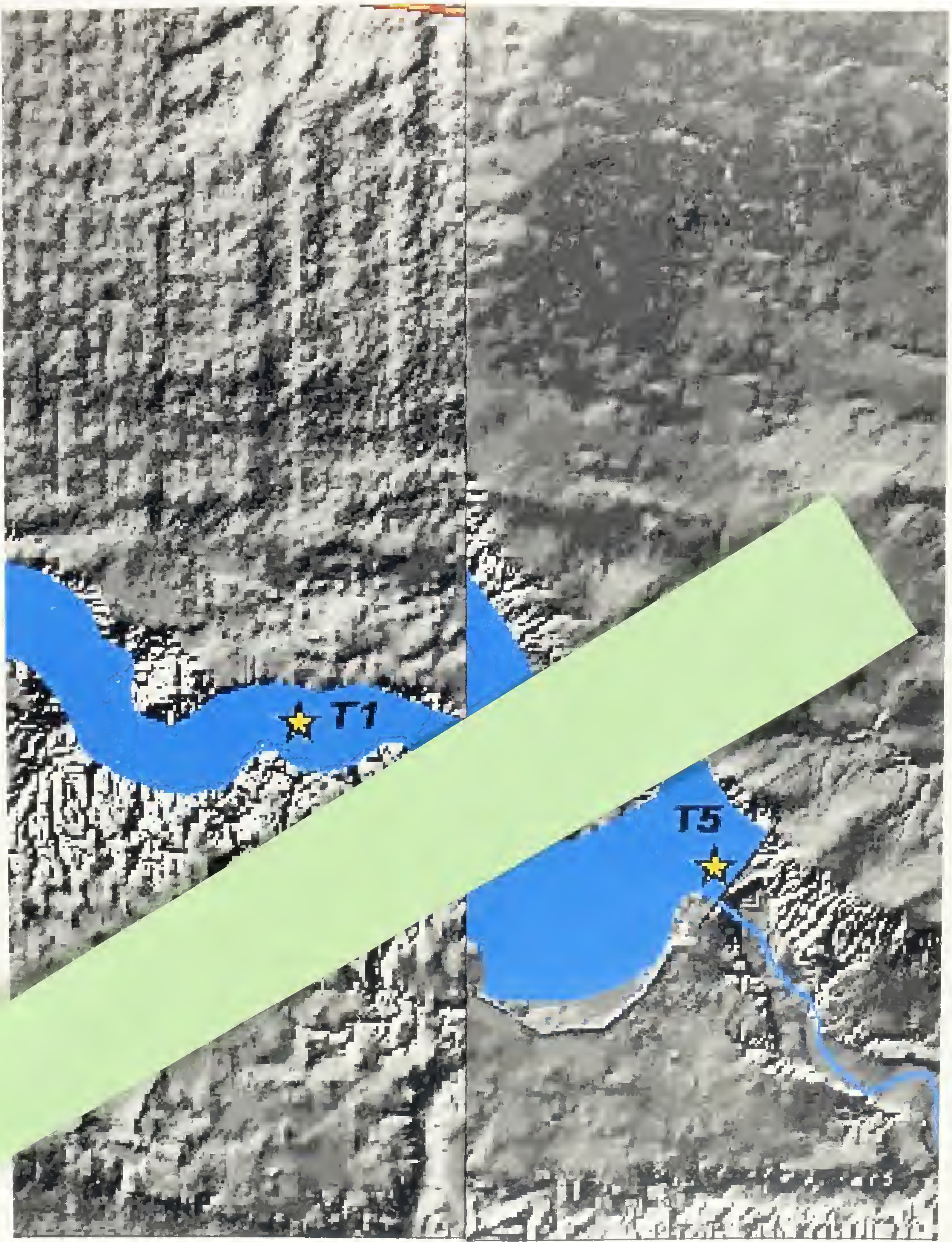


● PRELIMINARY DRAFT

'S / NORTH CENTRAL MONTANA
GIONAL WATER SYSTEM
IBER LOCATIONS

FIGURE
6-2

Turbidity in the reservoir was found to be above the acceptable limit for some treatment processes, particularly those that employ high rate loading. The maximum and average turbidity during the sampling period for the five Reclamation water quality sampling locations are shown in Figure 6-3. The T1 sample site is at the west end of Tiber Reservoir, with T2 through T5 progressing toward the east end. At the proposed intake location, turbidity was as high as 335.5 Nephelometric Turbidity Units (NTU). The nature and makeup of the turbidity is not known (i.e., colloidal, algae, etc.), but the high levels indicate that some pretreatment will be needed to minimize impacts to the treatment process.

The USGS data included analysis of constituents some of which are regulated. All of the regulated constituents were below the maximum contaminant level established by federal and state regulations.

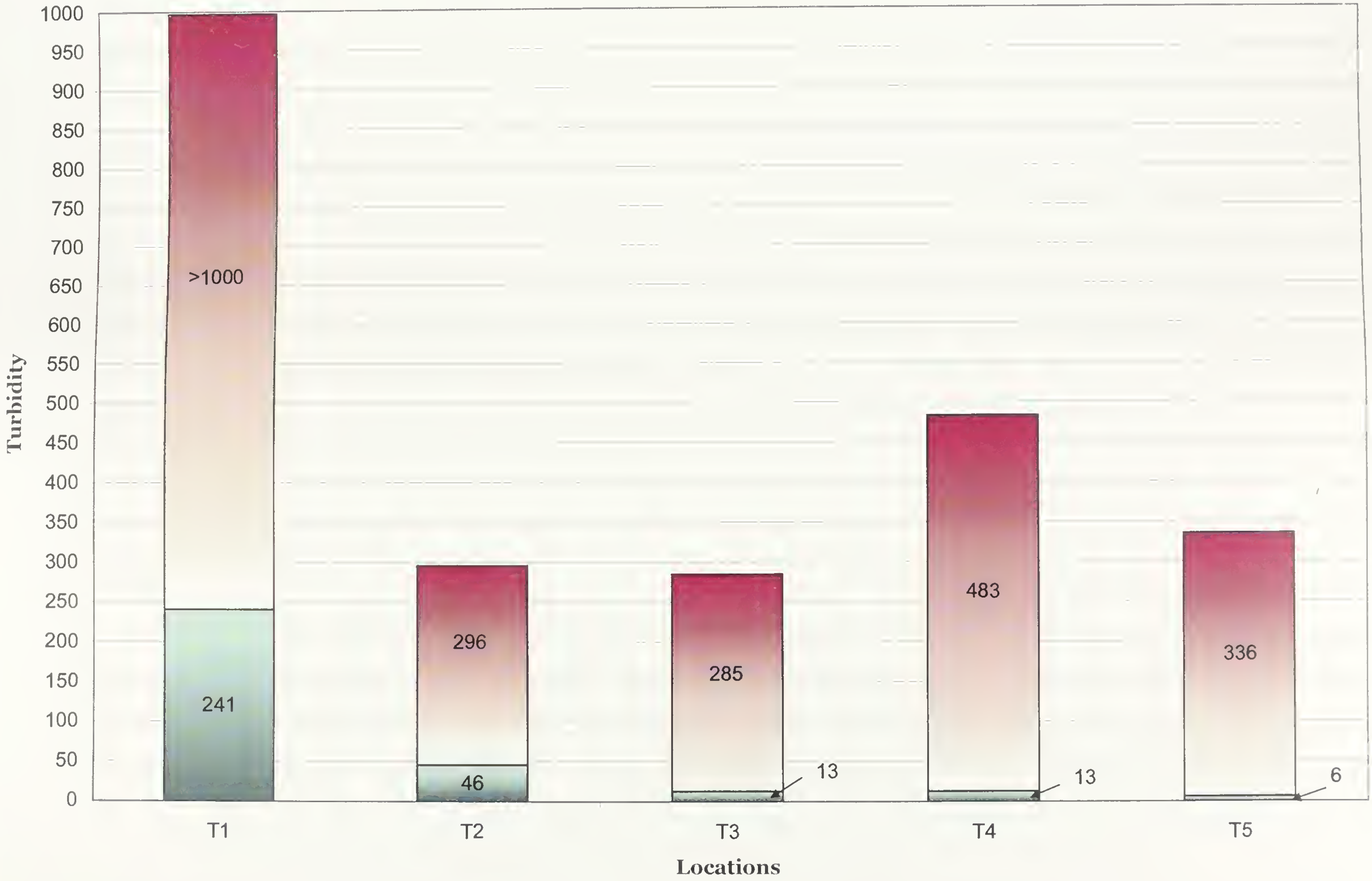
TABLE 6-1
TOTAL ORGANIC CARBON (TOC) CONCENTRATIONS AT SAMPLE POINT T5 (mg/L)

	Surface	30 feet Deep
5/2/2002	9.5	3.3
6/12/2002	2.9	2.8
7/9/2002	6.0	5.5
8/13/2002	4.9	4.6
9/16/2002	4.8	4.6
10/8/2002	< 1.0	< 1.0
Average	4.7 to 4.9	3.5 to 3.6

The elevated levels of TOC and turbidity make membrane treatment less attractive than conventional treatment because a pretreatment step may be required upstream of the membranes. Also, conventional treatment using sedimentation and filtration is capable of removing the required amounts of TOC and turbidity. Thus, conventional treatment using sedimentation and filtration is potentially more cost effective than using membranes with a pretreatment step.

A potential raw water quality consideration that had been identified previously is mercury. Inorganic mercury is a regulated contaminant of the Safe Drinking Water Act (SDWA) with a maximum contaminant level of 0.002 mg/L in finished drinking water. The EPA National Primary Drinking Water Standards (NPDWS) identify kidney damage as the potential health effect of mercury contamination. Potential sources of mercury contamination in drinking water can include erosion of natural mercury deposits, discharge from refineries or factories, and runoff from landfills or croplands.

Figure 6-3 - Maximum and Average Turbidity for Tiber Reservoir Sampling Locations



H:\06\M414130\HDR\Max and avg TURB for location\Fig 6-3.xls

According to the Montana Department of Environmental Quality (DEQ), mercury has never been detected in water samples from public water supplies that obtain water from Tiber Reservoir or the Marias River. However, the Montana Department of Public Health and Human Services has documented the bioaccumulation of methylmercury compounds in some fish from the Tiber Reservoir. Naturally, any report of mercury in a potential drinking water source is a matter of concern. However, the presence of methylmercury in some fish species is not necessarily a drinking water concern, nor is it inconsistent with the water quality sampling that indicated an absence of mercury in the water column. To understand why this is the case, it is important to explain how bioaccumulation of mercury occurs.

Methylmercury is transformed from inorganic mercury in the sediments of lakes and streams into organic methylmercury by benthic (sediment dwelling) microorganisms[1]. The source of the original mercury can be industrial or mining pollution, but it can also be naturally occurring mercury, which is likely the case in the Tiber reservoir. The conversion of the inorganic mercury to an organic form usually occurs as the result of an anaerobic respiration process. The methylmercury is then accumulated by benthic macro invertebrates on the reservoir bottom that ingest the mercury-processing microorganisms. These macro invertebrates are in turn consumed by higher order species in the food chain, eventually accumulating and concentrating the mercury at the apex of the fish food chain, usually a salmonid.

The bioaccumulation of the mercury is accomplished absent any meaningful level of dissolved mercury in the water column. In fact, mercury is highly insoluble in water. The best-described case studies of mercury bioaccumulation are from the Great Lakes Region, where very high levels of mercury have been found in salmon and other fish species, but the level of mercury in the water column remains at near non-detectable levels.

The Tiber River reservoir is a high quality water source that is readily treatable and should provide a reliable and largely mercury-free source of drinking water. Although the issue of aquatic bioaccumulation of mercury in this reservoir may deserve additional study, it is highly unlikely that it represents a threat to its use as a drinking water source.

6.3.2 Current Regulations

Taken as a group, the thrust of the current drinking water regulations is to ensure that drinking water is microbially safe, that it contains minimal disinfection byproducts, and that it does not contain excess levels of metals due to corrosion of piping materials. Compliance with the rules requires each treatment plant not only to produce water that meets the regulated water quality standards, but also to meet specific monitoring requirements and treatment techniques.

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[1] National Academy of Sciences. Drinking Water and Health. Safe Drinking Water Committee, Advisory Center on Toxicology. Assembly of Life Sciences, National Research Council. Pages 270 – 279. Washington, D.C. 1977.

Current regulations that will impact the treatment practices of the water treatment plant are listed below and summarized briefly. Some of these rules regulate contaminants or set up treatment techniques that must be met by water treatment plants. In addition, there is a long list of organic and inorganic chemicals that are regulated with maximum contaminant levels in drinking water. Sampling for this suite of contaminants is part of the routine monitoring for all treatment plants. On a day-to-day basis many of these contaminants will not be a major concern to the new treatment plant, but for reference purposes, the EPA listing of all the National Primary Drinking Water Standards is included as Appendix D.

6.3.2.1 Lead and Copper Rule and Revisions

The Lead and Copper Rule and its revisions require utilities to have a corrosion control strategy. Each treatment plant must establish a corrosion control program that is approved by the State. Potentially, the Lead and Copper Rule can have a significant impact on sampling, analytical and operating costs, as well as a substantial capital cost for treatment facilities. Design of the treatment processes must incorporate treatment schemes, which ensure that stable, noncorrosive water is produced at the plant. The goal of the treatment related to the Lead and Copper Rule is for the water leaving the plant to have a high enough pH to minimize corrosion and high enough alkalinity to maintain the pH.

The effect of this rule on the water treatment plant will not be known until further water sampling is completed. If the source water is corrosive, chemical addition would be required for pH and/or alkalinity adjustment, calcium adjustment, or to inhibit corrosion. The action level for lead is exceeded if more than 10 percent of the targeted tap samples are greater than 0.015 mg/L. The action level for copper is exceeded if more than 10 percent of the targeted tap samples are greater than 1.3 mg/L. If the action levels are exceeded, the rate of chemical addition would be adjusted to reduce the quantity of samples exceeding the action levels.

6.3.2.2 Surface Water Treatment Rule

The Surface Water Treatment Rule (SWTR) requires that water treatment plants show a specified level of treatment for *Giardia* and viruses. The disinfection requirements for filtering systems are:

- Disinfection must be sufficient to ensure 3-log inactivation of *Giardia* and 4-log inactivation of viruses as determined by the State DEQ;

- The residual disinfectant cannot drop below 0.2 mg/L for more than four hours; and

- Residual disinfectant must be detectable in more than 95 percent of samples taken in the distribution system each month.

The SWTR previously required that plants meet specific turbidity levels for the combined filter effluent. These requirements are superceded by the new turbidity limits set forth in the Interim Enhanced Surface Water Treatment Rule (IESWTR).

6.3.2.3 *Interim Enhanced Surface Water Treatment Rule (IESWTR)*

The IESWTR sets up new turbidity requirements for both the combined filter effluent and the individual filter effluent. The combined filter effluent must not exceed 0.3 NTU for 95 percent of the 4-hour readings each month. Individual filter effluent turbidity levels must be monitored continuously and must be evaluated monthly. Monitoring individual filters continuously requires the ability to tap each filter effluent line before the filter effluent is combined. In addition, the turbidity must be recorded electronically for plant operations staff to be able to handle and review the quantity of turbidity data generated by this requirement. Turbidimeters at the plant must be maintained and calibrated at regular intervals and documentation of maintenance and calibration is required.

Individual filter turbidity performance requirements in the rule set up a required action if one of the triggers is exceeded. All individual turbidity triggers are based on two consecutive 15-minute measurements. An exception report to the State is required if:

- Individual filter effluent is greater than 1.0 NTU at any time during filter operation; or
- Individual filter effluent is greater than 0.5 NTU after the first four hours of operation.

Filter profiles, or a graphical representation of individual filter performance over time, for individual filters must be produced within seven days of the exceedance for inclusion in the exception report. A filter self-assessment, or a more intense look at the other aspects of filter media than a filter profile, is required when effluent for an individual filter is greater than 1.0 NTU at any time in three consecutive months. A State or third party Comprehensive Performance Evaluation of the plant is required when effluent for an individual filter is greater than 2.0 NTU at any time in two consecutive months.

The State of Montana regulations contain less stringent additional treated water turbidity and disinfection requirements as follows:

- Turbidity at the point of entry to the distribution system cannot be more than 1.0 NTU;

- Individual filter turbidity must be at or below 0.5 NTU in 95 percent of the samples taken and at no time be more than 5 NTU; and

- Residual disinfectant concentration cannot be below 0.2 mg/L using the DPD Method or 0.1 mg/L using the amperometric titration method.

6.3.2.4 *Total Coliform Rule*

All drinking water systems must continue to comply with the Total Coliform Rule (TCR), which limits the number of positive total coliform samples allowed each month in the distribution system. The Federal regulatory process is beginning to move towards drafting a new distribution system rule, which may modify the TCR to include best management practices in distribution systems and other suggestions. The best management practices may consist of a systematic evaluation of the distribution system to ensure water quality is maintained, to identify areas with potential for microbial regrowth, and to establish a systematic flushing program for distribution system management. This new rule is not likely to be proposed until late 2004 or early 2005.

6.3.2.5 *Stage 1 Disinfection/Disinfection By-Products (D/DBP) Rule*

The Stage 1 D/DBP Rule sets maximum contaminant levels (MCLs) for disinfection byproducts, including total trihalomethanes (TTHM) at 80 μg/L and five of the haloacetic acids (HAA5) at 60 μg/L. Compliance with these MCLs is based on a running annual average of quarterly averages of all the required samples. Monitoring must take place quarterly for TTHM and HAA5 at four sites in the distribution system for each plant in the system. An MCL is also set for chlorite, a byproduct of chlorine dioxide, at 1.0 mg/L. Chlorite must be measured daily at the entrance to the distribution system and monthly at three sites in the distribution system. Exceeding the MCL on the daily sampling triggers additional distribution system sampling, although it is not by itself a violation. Compliance with the MCL is based on the average of each three monthly distribution system sample results. The MCL for bromate is set at 10 μg/L and must be measured monthly at the entrance to the distribution system if the water treatment plant uses ozone as a disinfectant.

The rule also sets Maximum Residual Disinfectant Levels (MRDL) for disinfectants commonly used in water treatment. These enforceable standards are set at 4.0 mg/L as Cl_2 for chlorine and chloramines and at 0.8 mg/L for chlorine dioxide. Chlorine and chloramines are measured regularly each month at total coliform sample sites and the results are averaged monthly. Each quarter, the running annual average of the monthly averages is calculated and must be below the MRDL to maintain compliance.

Chlorine dioxide samples are taken daily at the entrance to the distribution system. If any sample exceeds the MRDL, three additional samples must be taken in the distribution system the following day. Chlorine dioxide results can lead to an acute or a non-acute violation. If any two consecutive daily samples taken at the entrance to the distribution system exceed the MRDL, and all distribution system samples taken as a result of those exceedances are below the MRDL, the system is in violation of the MRDL and corrective action must be taken to lower the level of chlorine dioxide below the MRDL at the point of sample. In addition, the public must be notified following the procedures for non-acute health risks. An acute violation occurs if any daily sample taken at the entrance to the distribution system exceeds the MRDL, and on the following day one (or more) of the three samples taken in the distribution system exceed the MRDL. Immediate corrective action must then be taken to lower the level of chlorine dioxide below the MRDL and the public must be notified following the procedures for acute health risks. In addition to regulating levels of DBPs and disinfectants in finished water, the Stage 1 D/DBP Rule requires plants that use conventional treatment to remove a specified percentage of the total organic carbon (TOC) found in the raw water (see Table 6-2). Removal of TOC is a treatment technique for DBP precursor control. The interaction between free chlorine and natural organic matter is known to be the source of the regulated DBPs and numerous other disinfection byproducts. By reducing the precursors, the level of DBP development is reduced.

TABLE 6-2
TOTAL ORGANIC CARBON (TOC) REMOVAL REQUIREMENTS

Source Water TOC (mg/L)	Source Water Alkalinity (mg/L)		
	0-60	**> 60-120**	**>120**
> 2.0 to 4.0	35%	25%	15%
> 4.0 to 8.0	45%	35%	25%
> 8.0	50%	40%	30%

Preliminary water quality data indicate the raw water TOC may fall into the 4.0 to 8.0 mg/L range. Alkalinity data is not yet available. Additional water quality data is needed to determine where the Tiber Reservoir source water fits in this range.

6.3.2.6 *Filter Backwash Recycling Rule*

The first part of the Filter Backwash Recycling Rule, which does not apply to the new water treatment plant, requires existing systems to notify the State by December 2003 if the system recycles spent filter backwash water, thickener supernatant, or liquids from dewatering processes. The second part, which does apply to the new plant, is that any plant that recycles must send its recycle flow to the head of the plant where it will be completely retreated through all processes. The proposed treatment schematic in Figure 6-1 shows this approach. Records must be kept for State review of the following:

- Copy of the recycle notification;
- List of all recycle flows and the frequency of return;
- Average and maximum backwash flow rate and duration of backwash;
- Typical filter run length and written description of how filter run length is determined;
- Type of treatment provided for recycle flow; and
- Design data on the plant treatment units, hydraulic loading rates, chemicals used with dose and frequency, and frequency of solids removal.

6.3.2.7 Radionuclides Rule

The Radionuclides Rule sets MCLs for combined radium (Ra-226 and Ra-228) at 5 pCi/L, for Gross alpha at 15 pCi/L, for Uranium at 30 μg/L, and for beta/photon radioactivity at $\leq$ 4 millirem/year. While compliance with this rule may not be an issue for many plants, the rule has generated an adjunct problem. When systems with significant levels of radionuclides practice enhanced coagulation, it is possible that the resultant sludge can have concentrations of radionuclides that can be problematic from a disposal standpoint. Radionuclides samples have not been taken in Tiber Reservoir, so the effect of this rule is not yet known.

6.3.2.8 Arsenic Rule

The Arsenic Rule sets a new MCL for arsenic at 10 μg/L with a compliance date of January 2006. Arsenic levels can be high in groundwater sources but are not usually high in surface sources. The impact of the arsenic rule to surface water systems is generally limited to the required monitoring which will occur in conjunction with other inorganic contaminant monitoring. For systems that have arsenic above 5 μg/L and below 10 μg/L, additional treatment is not required, but specific arsenic language must be included in the Consumer Confidence Report. Arsenic data available for the Marias River indicate maximum arsenic concentrations of 2 μg/L.

6.3.2.9 Consumer Confidence Report Rule

The Consumer Confidence Report (CCR) Rule requires every public water supply system to summarize information from regulatory compliance monitoring in a report that is sent to all customers once a year in July. The rule went into effect in 1998, with the first report due to customers in 1999. The CCR includes information on a system's source water, levels of detected contaminants, compliance with drinking water rules, and some educational material. It is anticipated that this report will be generated and distributed by the Authority to member water systems for distribution to their individual customers.

6.3.3 Future Regulations

Two future rules, the Stage 2 DBP Rule and the Long-term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), are in the proposal stage. EPA published official proposals for these rules in August 2003 and expects to finalize the rules in Fall 2004. Jointly, these rules are referred to as the Stage 2 M/DBP Rules.

6.3.3.1 Stage 2 DBP Rule

The Stage 2 DBP Rule will change chlorinated DBP compliance to a Locational Running Annual Averages (LRAA) basis, rather than system-wide averages, using the same MCLs as the Stage 1 D/DBP Rule (80 μg/L for TTHM and 60 μg/L for HAA5). Implementation of the LRAA concept will occur in two stages, labeled Stage 2A and Stage 2B. In addition, the Stage 2 DBP Rule will require utilities to do an Initial Distribution System Evaluation (IDSE) to find those sites in the distribution system that have the highest DBPs. The three compliance steps are as follows:

- Initial Distribution System Evaluation must be complete two years after the rule publication. (Projected date for completion is 2006);

- Stage 2A must be met 36 months after rule publication. Stage 2A requires systems to meet 120 μg/L and 100 μg/L for TTHMs and HAA5s, respectively, as an LRAA at the current sampling sites being used for Stage 1 DBP Rule compliance. Systems must continue to meet the Stage 1 DBP Rule requirements. (Projected date for compliance is 2007); and

- Stage 2B must be met 90 months after rule publication. Stage 2B requires systems to meet 80 μg/L and 60 μg/L for TTHMs and HAA5s, respectively, as an LRAA at the newly defined sample sites selected as a result of the IDSE. (Projected date for compliance is 2012).

Monitoring under the IDSE requirement will consist of sampling at additional sites beyond those currently sampled for compliance. The proposed rule requires sampling at eight additional sites for each treatment plant; however, EPA has solicited comments on basing the number of sampling sites on population served rather than on the number of treatment plants. Samples must be taken every other month for a year at the additional sampling site and analyzed for TTHM and HAA5. Using these sampling results, systems must select one compliance site where DBPs are the highest. The rule will allow alternative methods of finding the highest TTHM sites in the system using modeling. The modeling approach requires combining a calibrated hydraulic model with water quality information on the kinetics of DBP formation in the particular system being modeled.

6.3.3.2 Long-term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR)

The objective of the LT2ESWTR is to reduce the risk associated with *Cryptosporidium* in drinking water. Sampling of raw water sources for *Cryptosporidium* will be required for large systems under the LT2ESWTR. Small systems (< 10,000 persons) will be required to complete 12 months of source water monitoring for *E. coli* at least once every two weeks beginning no later than 20 months after the rule is finalized. Monitoring reports will be submitted to the State. If the *E. coli* levels in the raw water exceed 20 *E. coli*/100 mL in the reservoir, then the source water must be sampled for *Cryptosporidium* on a monthly basis for two years. Based on the raw water monitoring, the system will determine bin classification that defines any additional treatment requirement. If the *E. coli* level in the reservoir is less than 10 *E. coli*/100 mL, then the system is classified in Bin 1. If the system is triggered into doing the *Cryptosporidium* monitoring, then the bin classification is based on the highest average of all sample concentrations in any 23 consecutive months. Proposed treatment bins are shown in Table 6-3.

Once the level of treatment for *Cryptosporidium* is defined, a number of methods of meeting the treatment requirement can be considered. For conventional treatment plants, the most likely will be the addition of ultraviolet disinfection after filtration, with ozone disinfection being another option. The membrane filtration alternative would also provide the level of treatment required. Small systems must install treatment and comply with the treatment requirement no later than 102 months after rule publication. The projected installation and compliance deadline is 2013.

TABLE 6-3
EPA PROPOSED BINS FOR TREATMENT REQUIREMENTS BASED ON *CRYPTOSPORIDIUM* CONCENTRATION

Bin	Average *Cryptosporidium* Concentration	Additional treatment requirements for systems with conventional treatment
1	*Crypto* < 0.075/L	No action
2	0.075/L ≤ *Crypto* < 1.0/L	1.0-log treatment (0.5-log removal + 0.5-log inactivation or 1.0 log or greater from microbial toolbox
3	1.0 ≤ *Crypto* < 3.0/L	2-log treatment (with at least 1.0 log inactivation – e.g., UV, O_3, ClO_2, membranes, bag filters or bank filtration)
4	*Crypto* ≥ 3.0/L	3-log treatment (with at least 1.0 log inactivation – e.g., UV, O_3, ClO_2, membranes, bag filters or bank filtration)

6.3.3.3 *Contaminant Candidate List and Unregulated Contaminant Monitoring*

EPA has an ongoing requirement to maintain a list of contaminants that may be of concern in drinking water. The contaminant candidate list includes some contaminants for which there are insufficient analytical methods and some that are suspected to be in water but in unknown quantities. For those contaminants that do not have analytical methods, research has been initiated by EPA to develop methods. The unregulated contaminant monitoring program provides EPA with a vehicle for developing an occurrence database for those contaminants that are suspected to be in water. These programs, along with the regular 6-year review of existing regulations, will continue into the future to provide EPA with information for determining what additional regulations should be developed.

6.3.4 Regulatory Schedule

The Stage 2 M/DBP Rules have been under development for several years. Because these two rules were developed through a negotiated rule-making process, incomplete drafts of the rules have been available for some time. Based on the draft information, required compliance is expected three years from publication of the final rules. The official proposed rules were published in August 2003 and are expected to be finalized in Fall 2004.

If this sequence of events is not delayed further, the expected compliance date for DBP Stage 2A, the IDSE monitoring, and the LT2ESWTR requirement for *Cryptosporidium* monitoring will be in 2012. Phased compliance in the Stage 2 DBP Rule provides for small system compliance with Stage 2B in 2012. Compliance with the treatment technique specified by the *Cryptosporidium* bin classification will be required by 2010. This means that by 2013, if the utility is classified in *Cryptosporidium* Bin 2 or higher, treatment such as ultraviolet (UV) disinfection must in place and operating in order to be in compliance. The final facility design will include provisions for potential addition of UV. Table 6-4 presents a summary of regulations and compliance dates.

6.3.5 Expected Future Regulatory Impacts and Concerns

The initial major impacts from the Stage 2 M/DBP rules will be the monitoring requirements. The LT2ESWTR requires that within 30 months of the rule being finalized, small systems must begin monitoring their source water for *E. coli,* and turbidity for a 12-month period. In addition, because the IDSE monitoring required under the Stage 2 DBP Rule must cover one year, systems must begin to monitor for TTHMs and HAA5s at additional sites in the distribution system in order to complete the IDSE within two years after the Stage 2 DBP Rule is finalized. For systems that have begun monitoring prior to the rule being finalized, these timeframes will be less burdensome.

TABLE 6-4
CURRENT AND FUTURE SAFE DRINKING WATER ACT (SDWA) REGULATION SUMMARY

SDWA Regulation	Required Compliance Date	Key Provisions
Surface Water Treatment Rule (SWTR)	1989	Turbidity standard superceded by IESWTR; Disinfection required: 4-log removal of viruses, 3-log removal of *Giardia*
Total Coliform Rule (TCR)	1990	No more than 5% positive total coliform samples in a distribution system each month
Lead and Copper Rule	1992	Corrosion control and ongoing monitoring for lead and copper
Consumer Confidence Report Rule	April 1999	Yearly summary report on water system (CCR) must be sent to all customers by July of each year
Filter Backwash Recycle Rule	Dec 2003	Notify State in writing regarding recycle practices: plant schematic, typical flows.
		Return all recycle flows to the head of the plant
		Maintain records: Recycle notification, recycle flows, backwash flow rates, filter run lengths, recycle treatment, design data.
Radionuclides	Dec 2003	Sets MCLs for radioactive contaminants: Beta/photon emitters ≤ 4 mrem/hr; Alpha emitters ≤ 15 pCi/L; Combined radium ≤ 5 pCi/L; Uranium ≤ 30 µg/L
IESWTR	Jan 2004	Sanitary Survey once every three years; System must have specific records on file
		2-log *Cryptosporidium* removal
		Combined filter effluent 0.3 NTU 95 percent of time, not to exceed 1 NTU
		Continuous turbidity monitoring of individual filters
		Disinfection profile if TTHM > 64 ug/l or HAA5 > 48 µg/L
		Record-keeping, reporting and public notice
Stage 1 DBP Rule	Jan 2004	TTHM/HAA5 ≤ 80/60 µg/L (Running annual averages)
		Chloramine residual maximum = 4.0 as Cl_2
		TTHM/HAA5 compliance monitoring (4 samples per plant per quarter)
		TOC Removal 15-50 %, depending on raw water TOC and alkalinity, OR meet alternative compliance criteria
		Monitoring Plan (complete by 4/1/02)
Arsenic	Jan 2006	Sets MCL for arsenic ≤ 10 µg/L
Stage 2 DBP Rule	2006 (IDSE) 2007 (2A) 2010 (2B)	Initial Distribution System Evaluation (IDSE) requiring 8 additional sampling sites per plant (starting 2004)
		TTHM/HAA5 ≤ 120/100 µg/L as LRAA *and* TTHM/HAA5 ≤ 80/60 µg/L as RAA at Stage 1 DBP Rule sampling sites (Stage 2A)
		TTHM/HAA5 ≤ 80/60 µg/L as LRAA at new sampling sites (Stage 2B)
LT2ESWTR	2010 (Crypto Bin) 2013 (Treatment Technique)	Source water monitoring for assignment of Bin classification (starting 2006)
		Giardia/virus inactivation profiling
		Possible additional log treatment for *Cryptosporidium* depending on Bin classification (by 2013) (options include UV disinfection or membranes)

Once the *Cryptosporidium* monitoring is complete, bin classifications can be calculated for each plant to determine what level of additional treatment, if any, is required. All water treatment plants would be well advised to consider all the options in obtaining treatment credit. The rule will contain treatment options known as the "Microbial Toolbox" for use in obtaining *Cryptosporidium* removal credit. Microbial Toolbox "tools" range from showing extremely tight and consistent operations with a low turbidity limit of 0.15 NTU to installation of additional treatment processes such as UV disinfection or membranes.

It is anticipated that water treatment plant staff will complete the required sampling at the water treatment plant and in the transmission system. Simple analyses may be completed at the water treatment plant lab. Licensed labs are anticipated to provide out-sourced analysis for samples that require more complex work.

6.3.6 Additional Water Quality Data Needed and Summary of Regulatory Impacts

As noted previously, the water quality data available for Tiber Reservoir are limited and additional data are necessary to ensure the most cost-effective and best performing water treatment facilities are selected. The additional raw water quality data that are desirable for selection of the water treatment plant components and the frequency of sampling are shown in Table 6-5. This data should be collected over a minimum period of 12 months in order to understand the seasonal water quality changes that occur in Tiber Reservoir.

6.4 INTAKE AND PUMP STATION

Water must be withdrawn from Tiber Reservoir over a wide range of operating conditions, and then the water must be delivered through a pipeline to the water treatment plant for treatment. Water will be withdrawn from the reservoir through an intake structure and a raw water pump station will pump the water into the pipeline that ultimately delivers the water to the treatment plant. Due to the close interrelationship between the intake and pump station, these facilities must be developed jointly to ensure compatibility.

Initially, six potential intake/pump station alternatives were identified and analyzed. However, during the Value Engineering (VE) study, the following three alternatives were rejected:

- Alternative 1B-1 – This alternative would use the 72-inch pressure line and a new 30-inch tap in the right abutment of Tiber Dam as the source of water for the water treatment plant in place of the reservoir intake. The water would be conveyed to a plant site above the dam. It was rejected due to periodic shutdowns required for the 72-inch pressure line for maintenance, as well as water quality concerns stemming from the abutment pipeline withdrawing water from the bottom of the reservoir and lack of fish/debris screening;

- Alternative 1B-2 – This alternative is similar to 1B-1, however the water would be conveyed to a water treatment plant located below the dam rather than lifting the water to a water treatment plant above the reservoir. It was rejected for the same reasons as 1B-1.

- Alternative 1C – This alternative would involve moving the intake structure and raw water pumps along the Marias River keeping them on federal lands in lieu of locating the intake in Tiber Reservoir. It was rejected due to potential ice blockage of the river intake, environmental concerns, poorer water quality, additional pumping requirements, and fish screening concerns with the existing pipe inlet.

TABLE 6-5
RAW WATER QUALITY SAMPLING PARAMETERS AND FREQUENCY

	Initial Sampling		Routine Sampling	
Parameter	**Reservoir Location**	**Frequency**	**Reservoir Location**	**Frequency**
Turbidity	Surface & Outlet	One sample	Mid-level & Outlet	Monthly
Temperature	Surface & Outlet	One sample	Mid-level & Outlet	Monthly
PH	Surface & Outlet	One sample	Mid-level & Outlet	Monthly
Alkalinity	Surface & Outlet	One sample	Mid-level & Outlet	Monthly
Total Organic Carbon	Surface & Outlet	One sample	Mid-level & Outlet	Monthly
Total Hardness	Surface & Outlet	One sample	Mid-level & Outlet	Monthly
Iron	Surface & Outlet	One sample	Mid-level & Outlet	Monthly
Manganese	Surface & Outlet	One sample	Mid-level & Outlet	Monthly
Gross alpha	Surface & Outlet	One sample	Mid-level & Outlet	Quarterly
Radium 226/228	Surface & Outlet	One sample	Mid-level & Outlet	Quarterly
Uranium	Surface & Outlet	One sample	Mid-level & Outlet	Quarterly
Total dissolved solids	Surface & Outlet	One sample	Mid-level & Outlet	Quarterly
Inorganic rule metals	Surface & Outlet	One sample	Mid-level & Outlet	Quarterly
Color	Surface & Outlet	One sample	Mid-level & Outlet	Monthly
Fluoride	Surface & Outlet	One sample	Mid-level & Outlet	Quarterly
Dissolved organic carbon	Surface & Outlet	One sample	Mid-level & Outlet	Monthly
UV 254	Surface & Outlet	One sample	Mid-level & Outlet	Monthly
Arsenic	Surface & Outlet	One sample	Mid-level & Outlet	Quarterly
Nitrate/Nitrite	Surface & Outlet	One sample	Mid-level & Outlet	Quarterly
Phosphate	Surface & Outlet	One sample	Mid-level & Outlet	Quarterly
Sulfate	Surface & Outlet	One sample	Mid-level & Outlet	Monthly
Chloride	Surface & Outlet	One sample	Mid-level & Outlet	Monthly

The three remaining intake/pump station alternatives are summarized in Table 6-6. These alternatives are more fully described in the following sections.

TABLE 6-6
PROPOSED INTAKE/PUMP STATION SITE

Alternative	Description	Action
1	Dry Tap	Alternate if geotechnical investigations prove alternative 1A to be unfavorable.
1A	Use micro-tunneling for intake lateral pipes	Recommended
1D	Use directional drilling to create reservoir intake lateral with inclined submersible vertical turbine pumps	Alternate if geotechnical investigations prove alternative 1A to be unfavorable.

6.4.1 Alternative 1 Dry Tap

In this alternative, the intake facility would be a horizontal tunnel that obtains water from the reservoir by tapping into an existing tunnel for the auxiliary outlet works along the left embankment. This new horizontal intake tunnel would deliver water to a deep caisson (approximately 180 feet deep) where vertical turbine pumps would pump the water to the treatment plant.

This alternative, which is described in detail in the PER, is also limited to one intake and would require very long shaft/column pumps. Also, Alternative 1A (described below) is less costly than this alternative, and, as a result, this alternative will only be considered if Alternate 1A does not prove feasible.

Below is a summary of the advantages and disadvantages of a Dry Tap intake.

Advantages

- No additional penetration to the reservoir

Disadvantages

- More complicated construction, deeper excavation
- More costly construction
- Long shaft/column pumps
- Only one intake provided
- Periodic shutdown for maintenance

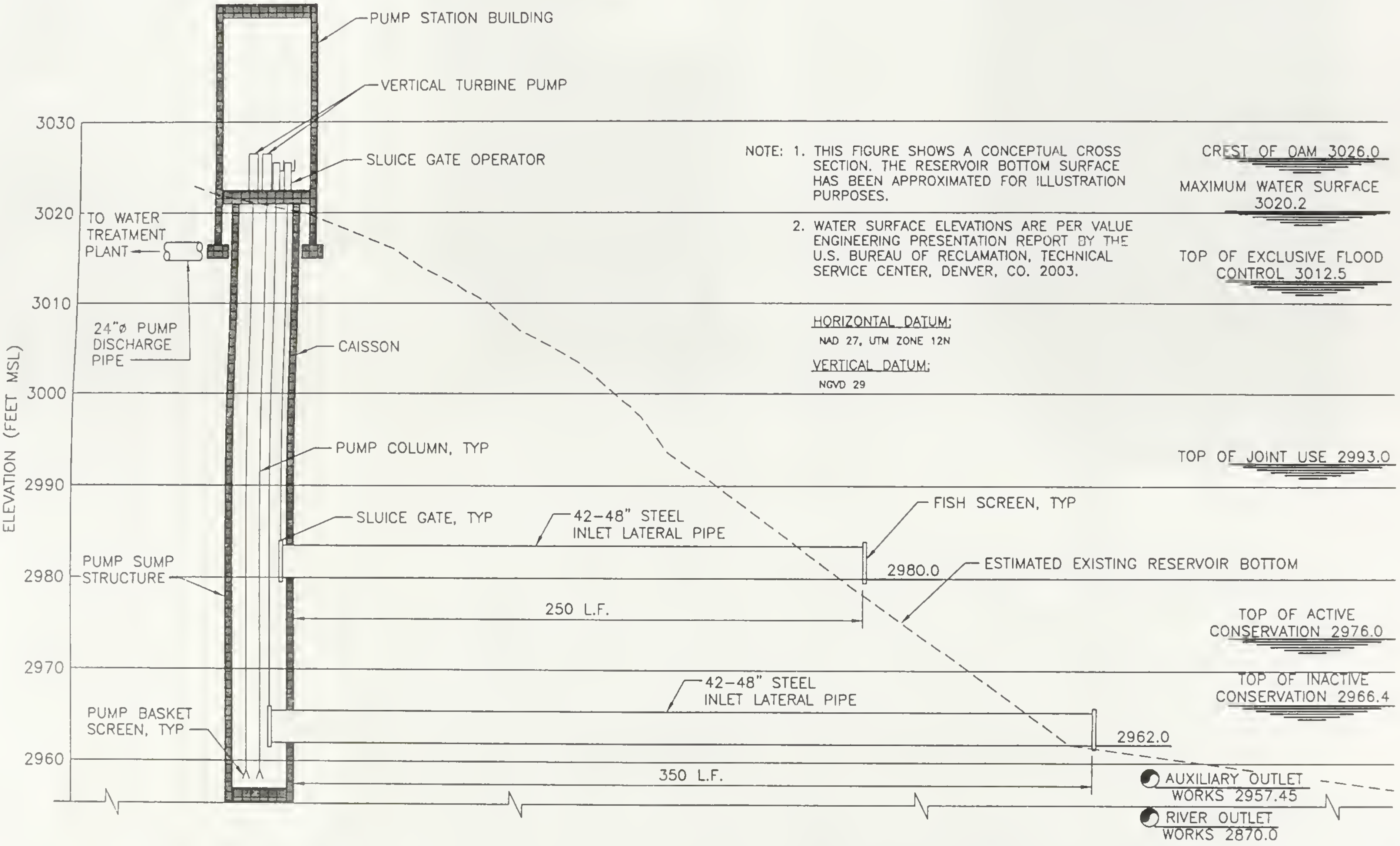
6.4.2 Alternative 1A Microtunneling

Example of Above Ground Caisso
Construction

For this alternative, the intake facility would be two 42-inch to 48-inch diameter (contractors option) horizontal laterals that would be microtunneled from a caisson into the reservoir, as shown in Figure 6-4. The first lateral would be at approximate elevation 2,980-feet and the other would be at about elevation 2,962-feet, allowing treatment plant operators the flexibility to change the level at which water is withdrawn. This flexibility will be particularly important when water quality varies with water depth, and having two intake laterals will provide redundancy. The upper lateral is estimated to be about 250 feet long and the lower lateral is estimated to be about 350 feet long, but an underwater survey would be needed to verify the length of the laterals.

Laterals pipes, which would have interlocking joints, would be heavy wall steel, strong enough to serve as both the carrier pipe and the tunnel-casing pipe. Each lateral would terminate in the reservoir on a concrete pier that also supports a fish screen. A barge would be needed during installation of the fish screens and their supports. Equipment would be lowered into the water and divers would install the fish screen on the inlet pipes and place the pier supports. If necessary, a barge-mounted pile driver could be used to install the piers that support the fish screen.

An electrically operated gate would be provided at the terminus of each lateral in the caisson, allowing each lateral to be independently isolated from the caisson. Closing both gates allows the caisson to be dewatered and it can then be kept dry with a small dewatering pump. This would allow subsequent construction or maintenance to be performed in a relatively dry environment.



NOTE: 1. THIS FIGURE SHOWS A CONCEPTUAL CROSS SECTION. THE RESERVOIR BOTTOM SURFACE HAS BEEN APPROXIMATED FOR ILLUSTRATION PURPOSES.

2. WATER SURFACE ELEVATIONS ARE PER VALUE ENGINEERING PRESENTATION REPORT BY THE U.S. BUREAU OF RECLAMATION, TECHNICAL SERVICE CENTER, DENVER, CO. 2003.

HORIZONTAL DATUM:
NAD 27, UTM ZONE 12N

VERTICAL DATUM:
NGVD 29

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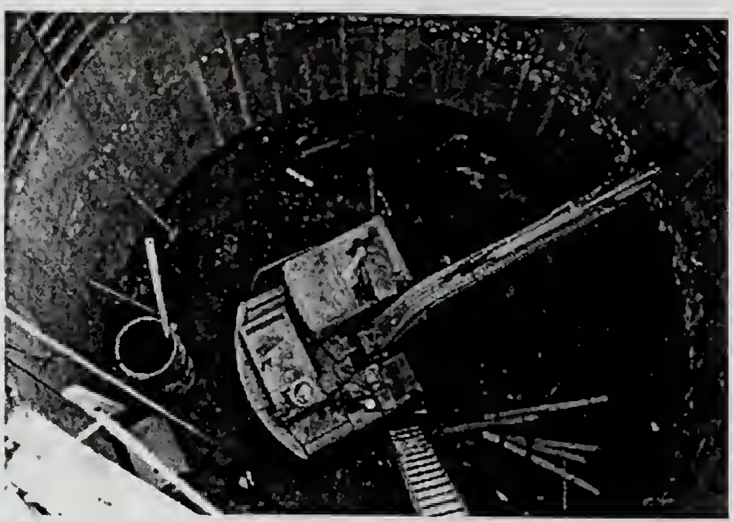
REGIONAL WATER SYSTEM
PROPOSED INTAKE/PUMP STATION

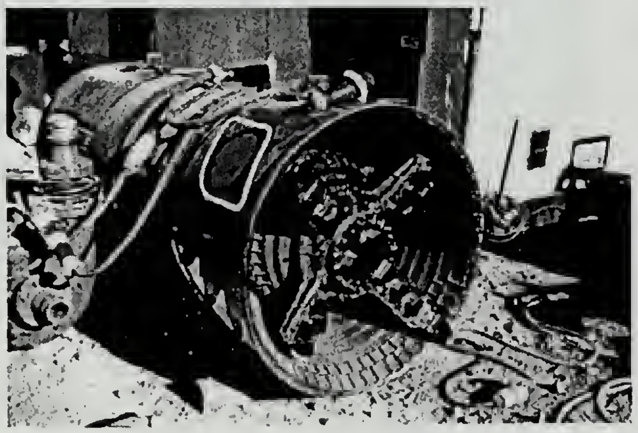
FIGURE
6-4

The caisson, which would be approximately 60 feet deep, would be located about 200 feet from the shoreline. The caisson, which serves as the wet well for the pump station, would be constructed in segments above grade and gradually lowered by excavating inside the cylinder. As the weight of the structure causes the cylinder to drop through the excavated opening, additional cylinder segments are placed on top. Eventually, the concrete cylinder reaches the bottom elevation and a concrete floor is poured underwater to seal the bottom and permit dewatering of the interior. Eventually, a pump station building would be constructed above the caisson to house the pumping equipment. Figure 6-5 shows the proposed layout for Alternative 1A.



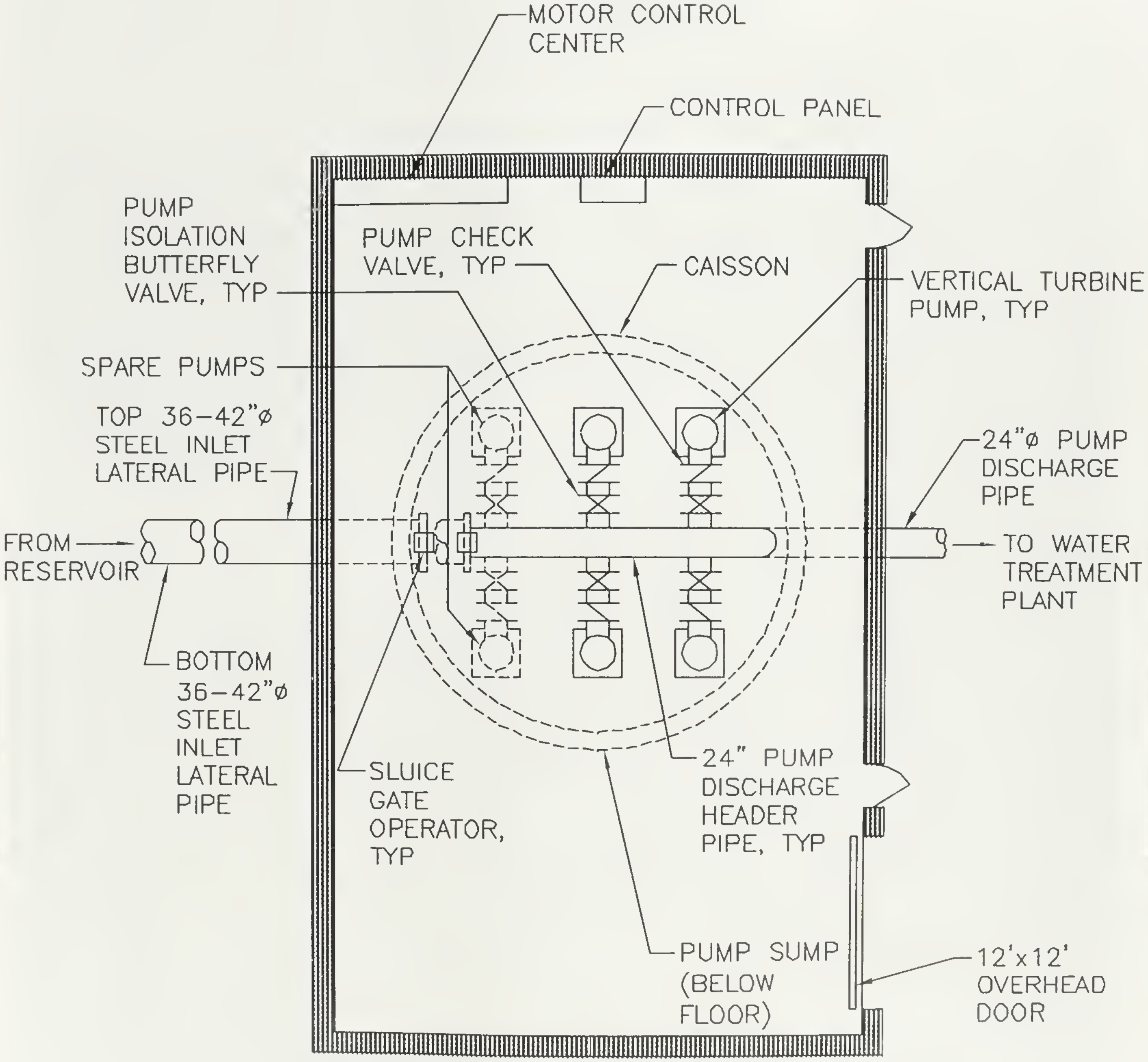
Example of Excavation Inside a Below Ground Caisson Construction

One of the critical issues related to this alternative is the soils that must be microtunneled. Ideally, soils between the caisson and the reservoir should be dense enough to provide ample resistance during tunneling to maintain the desired direction and to provide long-term support for the pipe. Non-uniform rock or loose soils that do not provide resistance to the boring machine will make navigation difficult, will be subject to settling, and may not provide adequate pipe support. The following paragraph describes the microtunneling process and illustrates why the soils must be appropriate for this construction procedure.



Example of a Tunnel Boring Machine

A tunnel boring machine (TBM) would be used to create the tunnel from the dry caisson to the reservoir. Steel pipe would be jacked into place as the TBM makes progress, and a water seal would be maintained between the pipe and the TBM to maintain a dry environment for the equipment in the caisson. The caisson structure would be unreinforced in the location where the boring machine penetrates the wall and additional reinforcing would be provided on the opposite side of the caisson so the jacking system can push against the wall. Once out of the caisson, the boring machine would be guided along its proposed alignment to the reservoir. A soil/rock slurry


MOTOR CONTROL CENTER
CONTROL PANEL
PUMP ISOLATION BUTTERFLY VALVE, TYP
PUMP CHECK VALVE, TYP
CAISSON
VERTICAL TURBINE PUMP, TYP
SPARE PUMPS
TOP 36–42"ø STEEL INLET LATERAL PIPE
24"ø PUMP DISCHARGE PIPE
FROM RESERVOIR
TO WATER TREATMENT PLANT
BOTTOM 36–42"ø STEEL INLET LATERAL PIPE
SLUICE GATE OPERATOR, TYP
24" PUMP DISCHARGE HEADER PIPE, TYP
PUMP SUMP (BELOW FLOOR)
12'x12' OVERHEAD DOOR

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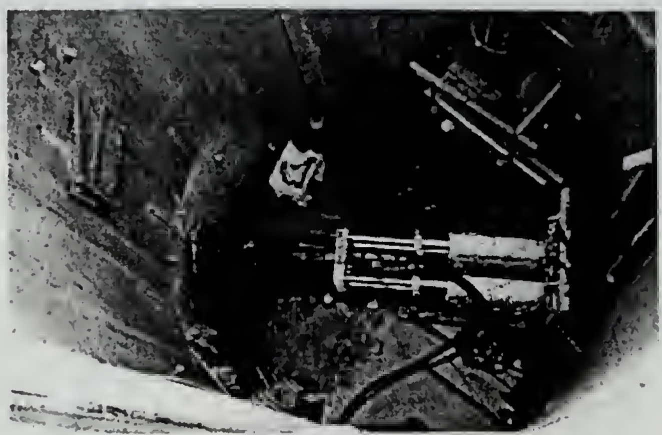
PRELIMINARY PUMP STATION LAYOUT

FIGURE
6-5

would be removed from the TBM and pumped to a temporary pond constructed on the surface where heavy solids would be settled and separated from the water. When the TBM reaches the reservoir, the jacking system would push the TBM into the reservoir, while maintaining the seal with the lateral pipe. The jacking machine would then be removed from the caisson and a gate would be installed in the caisson at the pipe outlet. Divers operating from a barge would then remove the TBM from the reservoir.

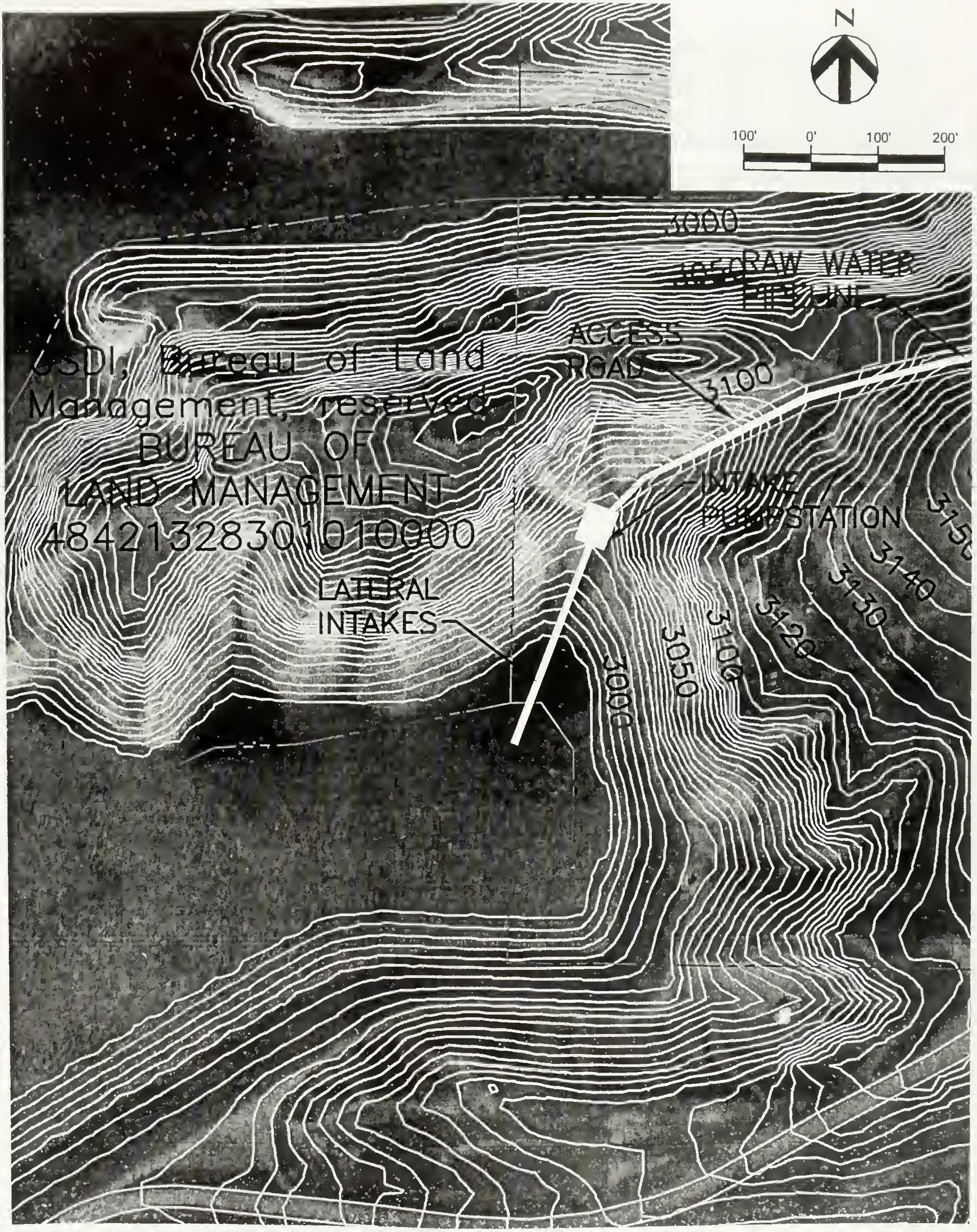
Currently, proposed location of the intake/pump station structure is also shown in Figure 6-6 (this location may change with final design). This location was chosen to take advantage of the lower surface elevations in the draw at the north end of the bay so the depth of the caisson will be minimized. A road would be constructed from the main road to the site to provide access.



Example of Jacking System for Microtunneling Construction

The pump station would be constructed directly above the caisson, utilizing the caisson as a wetwell for the raw water pumps. The base of the pump station would be at about elevation 3,020-feet. Vertical turbine pumps will be suspended from the pump station building into the wetwell structure with the pump bowls located below the lowest lateral inlet pipe. A basket screen would be provided at the pump inlet to protect the pumps from debris. Each pump would have discharge check and isolation valves. A pump discharge header pipe, located below the pump station, would connect to the transmission pipe that would deliver water to the water treatment plant (see Figure 6-5).

A Variable Frequency Drive (VFD) will be provided on one or more of the pumps to provide the ability to match flows with system demand. VFD units, working in combination with constant speed pumps, provide the ability to pump a wide range of flows. Initially, system demands could be as low as 1 mgd, and the ultimate flow rate is expected to approach 21.0 mgd. As shown in Table 6-7, the current plan to serve this wide range of flows includes four pumps, two of which will have VFD drives installed. Two of the pumps (Pumps 1 and 2) would cover the range of flows from 2.1 mgd to about 10.0 mgd and two larger pumps (Pumps 3 and 4) would meet demands from about 10.0 mgd up to the ultimate demand of 21.0 mgd. Note that when system demands are less than 2.1 mgd, it is anticipated that the water treatment plant will not operate for a portion of the day, and system demands will be met from terminal storage. Also, in the early years of system operations, when demands are low, the two larger pumps will not be needed so the purchase and installation of these two pumps can be deferred.



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INTAKE PUMP STATION SITE

FIGURE
6-6

The use of constant speed pumps, without VFD units, was also investigated, but this option was rejected since the wide range of flows would require significant pump throttling for many of the flow conditions. The increased head from throttling would force the pumps to operate less efficiently, would increase power costs, and could shorten equipment life. Continuous operation of pumps in a throttled condition can also cause overheating, bearing failure, or shaft failure.

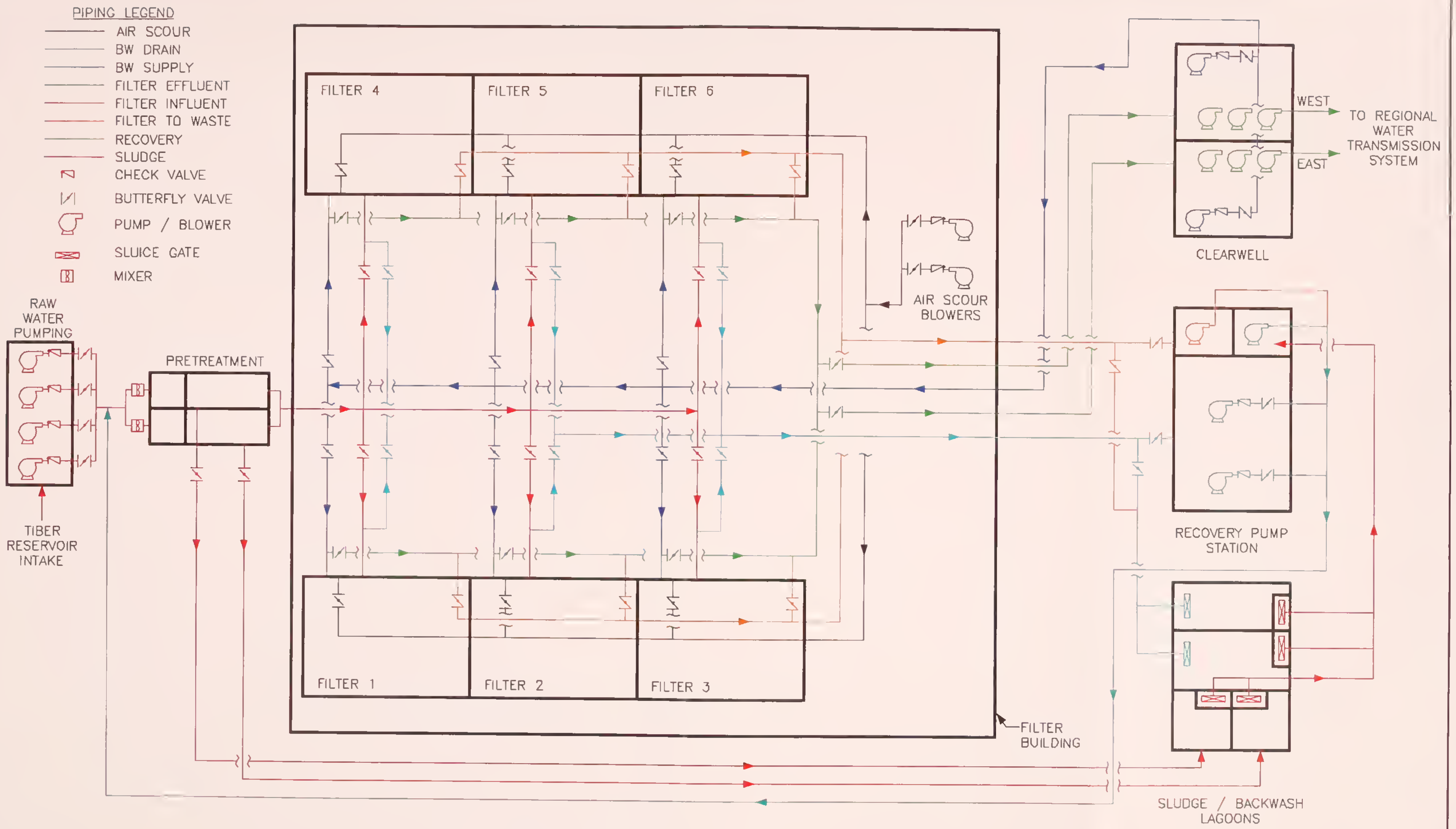
TABLE 6-7
RAW WATER PUMPS

	Capacity, mgd	Drive-Type	Hp
Pump 1	2.1-5.2	VFD	350
Pump 2	5.2	Constant	350
Pump 3	4.2-10.4	VFD	700
Pump 4	10.4	Constant	700
Firm Capacity	21.0		
Total Capacity	31.2		

Two pump types, vertical turbine or submersible, could be installed in the 60-foot deep wet well. After review of the maintenance requirements for both types of pumps, vertical turbine pumps were selected in lieu of submersible pumps because vertical turbines have relatively low maintenance requirements. Vertical turbine pump manufacturers suggest that the pumps be routinely pulled every five years for inspection and maintenance. To facilitate this operation, access hatches should be installed in the roof of the pump station to allow the entire pump assembly to be pulled with a truck-mounted crane.

The 5,000 foot long raw water pipeline to the water treatment plant must be sized to maintain adequate velocity in the line to prevent buildup of sediment and handle peak hydraulic flows. After reviewing the wide range of flows expected, a 24-inch pipeline is recommended for the initial construction phase. A 24-inch line will deliver the range of flows (2.1 to 21.0 mgd) at a minimum velocity of about 1.0 foot per second to a maximum of 10.0 feet per second. Two feet per second is typically the minimum desired velocity, but the system can periodically be operated at a rate of 4.0 mgd to achieve the minimum scour velocity and remove any accumulation. The maximum velocity of 10.0 feet per second will create surge conditions, but these will be addressed by providing surge anticipator valves in the pump station.

Water surface elevations that correspond to the various operating stages of Tiber Reservoir are also shown in Figure 6-4. These elevations were obtained from Page 64 of the VE Presentation



FILTRATION

NOTE: CHEMICAL APPLICATION POINTS ARE
SHOWN IN FIGURE 1.

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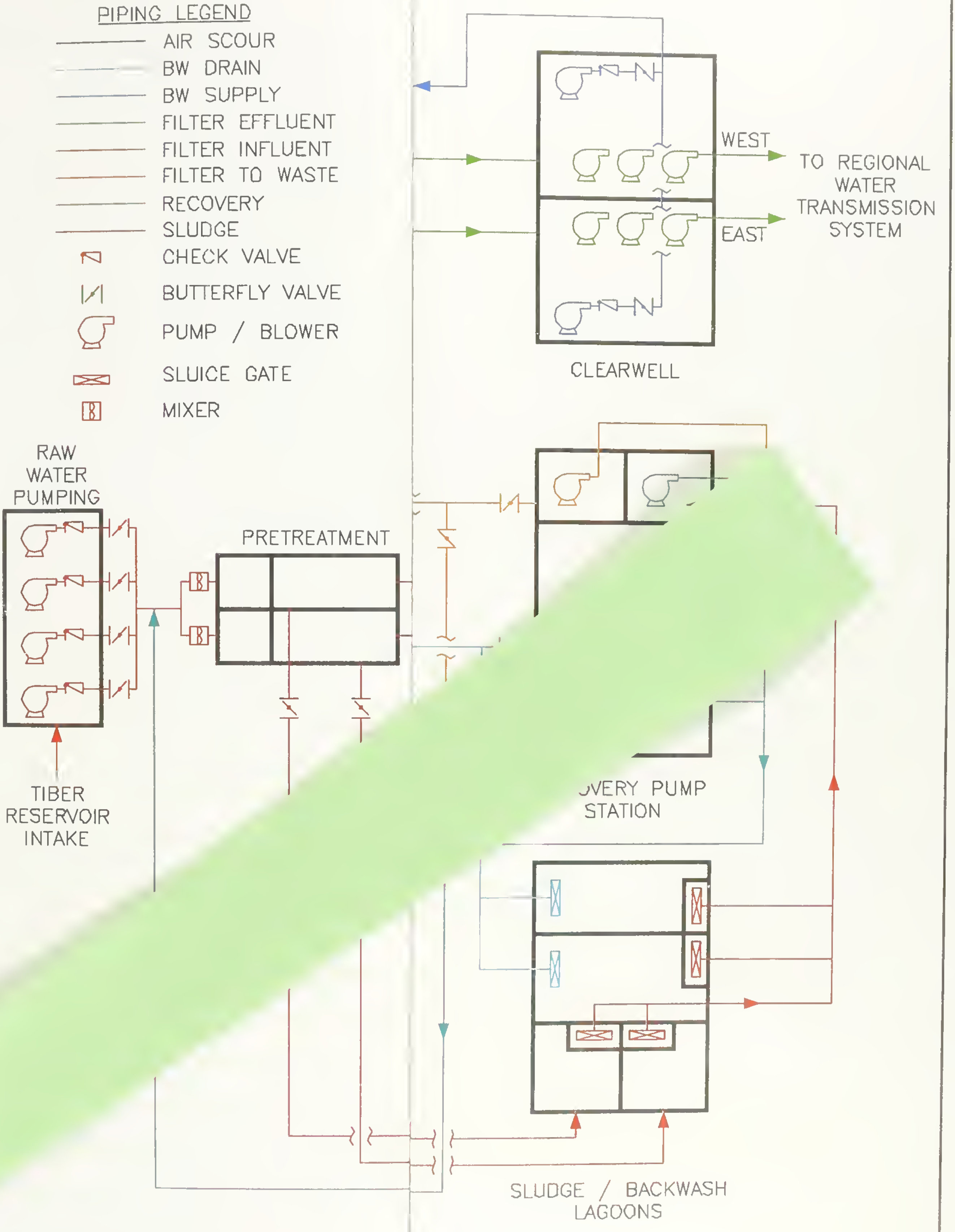
REGIONAL WATER SYSTEM
PLANT FLOW SCHEMATIC

FIGURE
6-7



NOTE: CHEMICAL APPLICATION POINTS A
SHOWN IN FIGURE 1.

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GIONAL WATER SYSTEM
T FLOW SCHEMATIC

FIGURE
6-7

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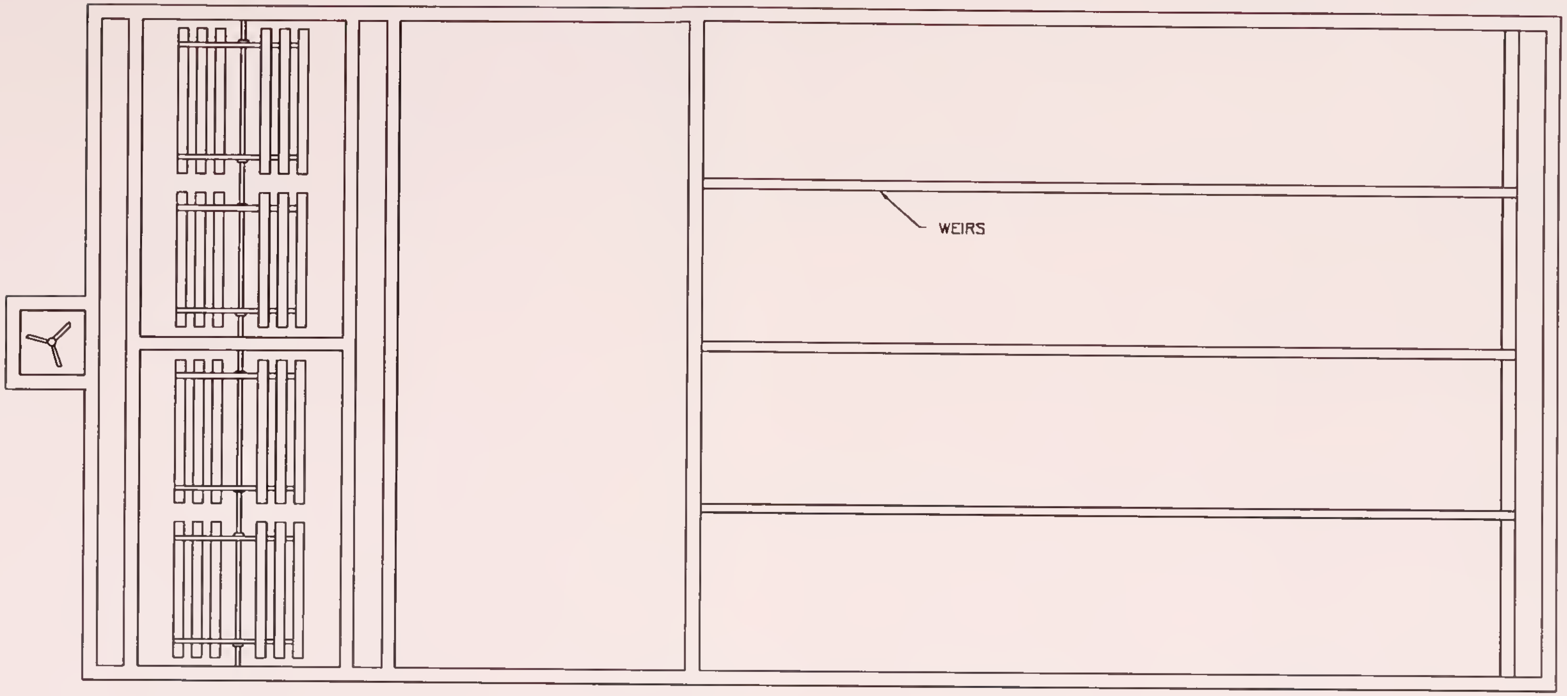
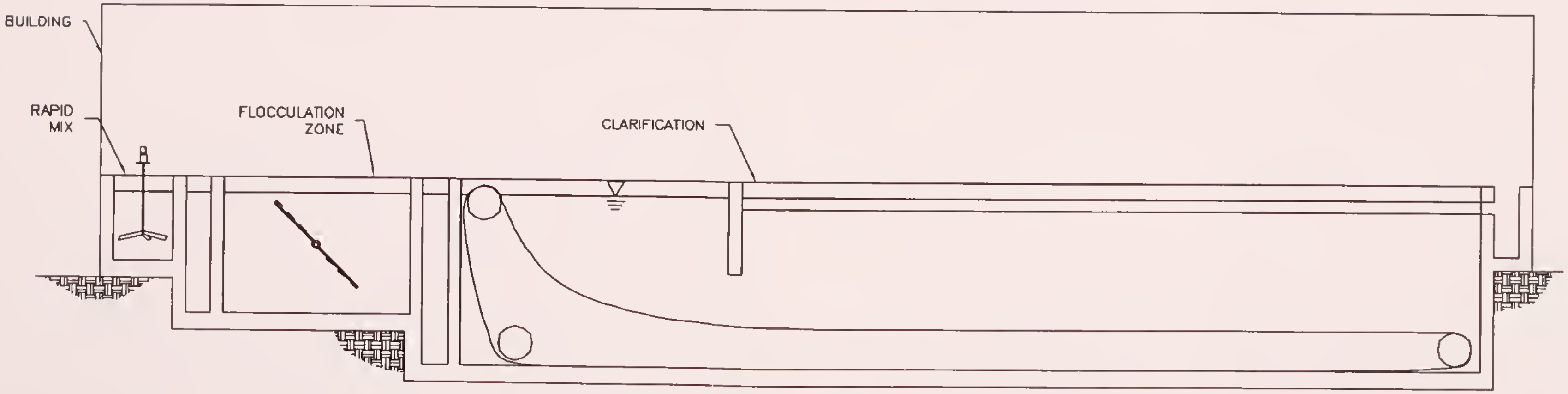


PLAN



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REGIONAL WATER SYSTEM
CONVENTIONAL SEDIMENTATION BASIN

FIGURE
6-9

Below is a summary of the advantages and disadvantages of conventional sedimentation.

Advantages
- Not mechanically intensive
- Not proprietary

Disadvantages
- Low rate of sedimentation – 0.5 gpm/ft^2 of basin area
- Larger footprint than newer technologies

6.5.2.2 Plate Settling Sedimentation

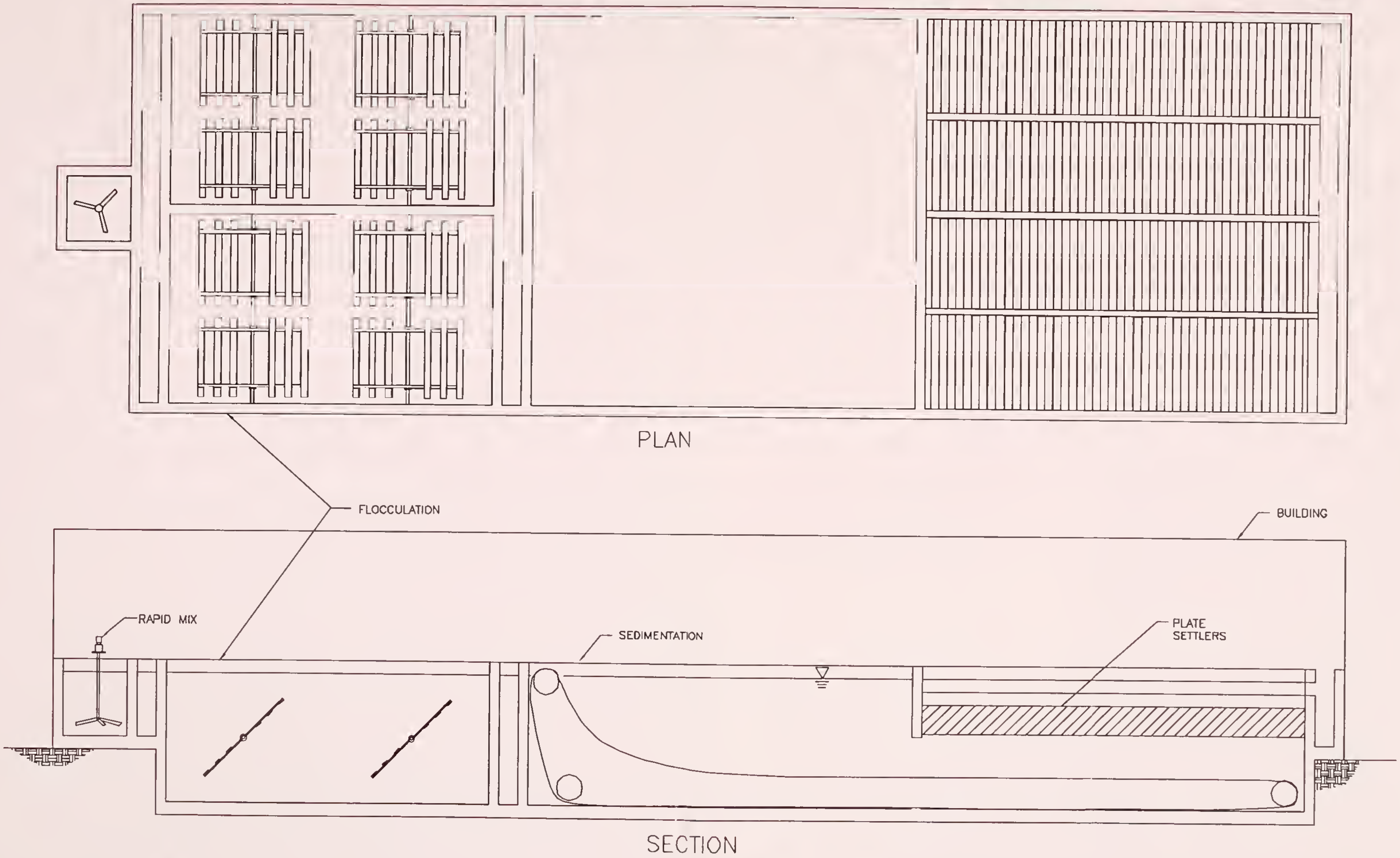
The theory of plate settling is to reduce the distance that coagulated particles have to settle, increasing the effective surface area in the settling zone. The surface area of the plates is significantly greater than the water surface area of the basin, allowing an approximate six-fold increase in flow rate compared to the same footprint in a traditional sedimentation basin. The plates are normally about 2 inches apart and are inclined at 60 degrees from the horizontal. As solids settle onto the plates, they begin to buildup and once there is a slight buildup the solids will slough down the steeply inclined plates and drop to the bottom of the basin. Mechanical equipment under the plates then moves the solids to a collection point for removal from the basin. Effluent troughs above the settling plates collect pretreatment effluent.

Rapid mix and flocculation, which precedes the plate settlers, would be similar to the processes for conventional sedimentation. Rapid mixing would be accomplished by a mechanical mixer in a square chamber with about 30 seconds of detention time. Two stages of flocculation would follow in basins with a detention time of 30 minutes. Horizontal paddle type flocculators would provide the gentle mixing needed to develop floc. Figure 6-10 shows plan and section views of a plate settling pretreatment alternative.

Below is a summary of the advantages and disadvantages of plate settling sedimentation.

Advantages
- High rate of sedimentation – up to 6 gpm/ft^2 of basin area
- Similar in operation to traditional conventional sedimentation
- Compact footprint due to higher loading rates

Disadvantages
- Plate settlers require periodic cleaning
- Larger footprint than Actiflo



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ROCKY BOY'S / NORTH CENTRAL MONTANA
REGIONAL WATER SYSTEM
PLATE SETTLING ALTERNATIVE

FIGURE
6-10

6.5.2.3 Actiflo

The Actiflo process is a proprietary high rate sedimentation process that uses microsand-enhanced flocculation to increase particle removal efficiency. The Actiflo process consists of rapid mix, coagulation, microsand and polymer injection, maturation of floc, and settling of floc. The microsand ballasted sludge is pumped from the settling tank to a hydrocyclone, where the microsand is separated from the sludge by centrifugal force. The sludge is continuously removed for sludge treatment, whereas the microsand is reinjected back into the Actiflo system and continuously recycled.

The first chamber is a mixing chamber, where the coagulant is mixed with the influent water. Polymer and microsand are added in the second mixing chamber, also called the sand injection chamber. Flocculation is provided in the third maturation chamber to enhance particle aggregation. Small particles attach to the heavier microsand that allows for rapid settling in the sedimentation basin.

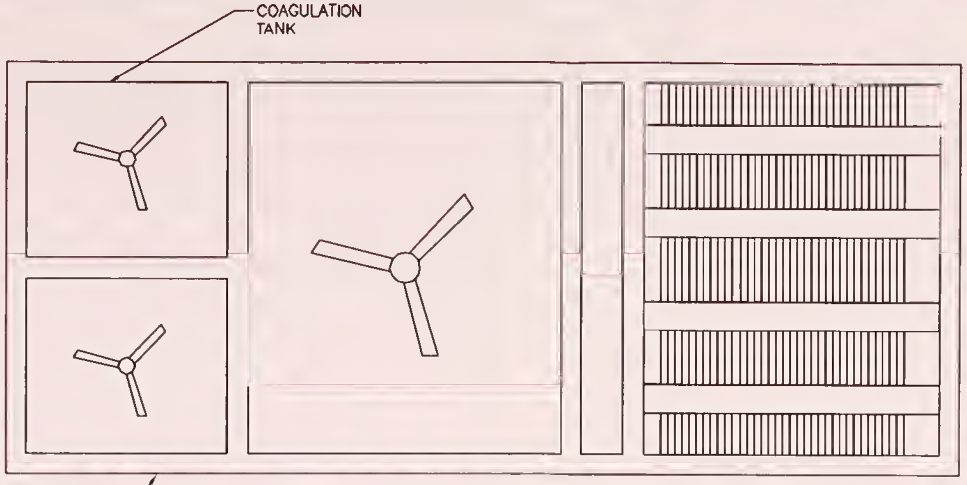
Settled solids are removed from the sedimentation basin and directed to a hydrocyclone. The hydrocyclone provides a zone of very high turbulence to shear attached particles from the microsand and separate the sand from the lighter particles. Sand is returned to the second mixing chamber while the solids are discharged from the system.

Due to the ability of the Actiflo process to handle turbidity fluctuations, a pre-sedimentation/equalization basin is not required. A pre-oxidation/aeration basin may be included for oxidation of dissolved metals and taste/odor elements if more extensive water quality data indicates it is necessary. Figure 6-11 shows plan and section views of an Actiflo process alternative.

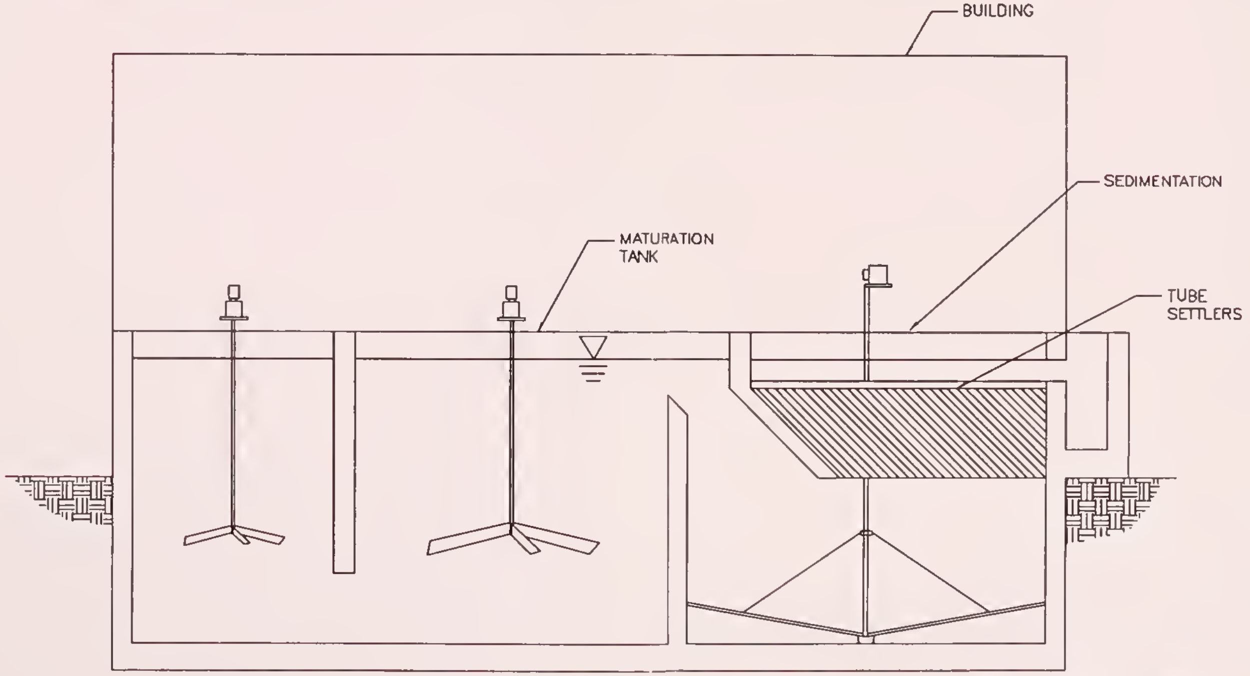
Below is a summary of the advantages and disadvantages of the Actiflo process.

Advantages

- Very high rate of sedimentation – up to 25 gpm/ft^2
- Ease of operation – fully automated system
- Very compact footprint due to high loading rates
- Energy efficient
- Can effectively treat rapid spikes in raw water turbidity and organics
- Combination of flocculation and clarification into one basin



PLAN



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ROCKY BOY'S / NORTH CENTRAL MONTANA
REGIONAL WATER SYSTEM
ACTIFLO SEDIMENTATION BASIN

FIGURE
6-11

Disadvantages

- System is proprietary – only one supplier
- Mechanically intensive system requires more maintenance
- Continuous replacement of microsand required
- Can be limiting at high turbidities

6.5.2.4 *Recommended Pretreatment Process*

Table 6-8 compares the three alternatives considered. Regardless of the pretreatment system selected, at least two parallel systems should be provided. Each system would have chemical feed, rapid mix, flocculation and clarification zones. Collected sludge would be discharged by gravity to the sludge ponds. Also, all facilities would be enclosed in a building to prevent freezing of equipment and water surfaces.

TABLE 6-8
DESIGN CRITERIA FOR PRETREATMENT ALTERNATIVES

	Conventional	Plate Settling	Actiflo
Rapid Mix, detention time, seconds	30	30	120
Flocculation Zone, detention time, minutes	30	30	2/2 [1]
Clarification Overflow Rate, gpm/sf	0.5	6	25
Clarification Detention Time, hours	4	0.50	0.1

[1] These values correspond to 2 minutes of detention time for each of 2 units in series.

Table 6-9 presents the total estimated capital cost of the three pretreatment alternatives. Detailed costs are included in Appendix E. Based on capital cost, Actiflo is the most attractive pretreatment alternative. However, pilot testing will be required to determine whether Actiflo is appropriate for the surface water in Tiber Reservoir. There could potentially be some water quality parameters that may preclude the use of the Actiflo units, however, based on the limited water data available, it appears the units should be appropriate. However, if pilot testing determines that Actiflo should not be used, then plate settling will be the preferred pretreatment process. Also, once more detailed water quality data is available, operations and maintenance costs will be included with capital cost to determine the present worth of each alternative. The final selection of the pretreatment system will be based on the overall cost, treatment capabilities and ease of operation of the selected system.

TABLE 6-9
PRETREATMENT ALTERNATIVE CAPITAL COSTS

Pretreatment Alternative	Estimated Capital Cost
Conventional Treatment	$9,350,000
Plate Settling	$6,345,000
Actiflo	$4,324,000

6.5.3 Filtration

During the VE study, microfiltration followed by GAC contactors was investigated in lieu of conventional filtration. Microfiltration appeared to be a good alternative for this project, especially if pretreatment could be avoided. However, recently obtained water quality information indicates that microfiltration without pretreatment would not be practical due to the high levels of Total Organic Carbon (TOC) in the raw water. High levels of TOC will create membrane-fouling problems, and the membrane process does not have a mechanism to remove dissolved organics. Therefore, the water would have to be pretreated prior to microfiltration, just as the water would have to be pretreated before conventional filtration. The GAC contactors would remove dissolved TOC that passed through the membranes, but would need to be replaced every 1-2 years due to the high organic content.

Although microfiltration using pressurized modules can be enhanced using coagulant chemicals or Powdered Activated Carbon (PAC) to remove dissolved organics, this approach is not considered effective for TOC levels greater than 4 mg/L. Submerged membrane equipment which uses vacuum pressure in combination with flocculation are capable of removing the higher levels of TOC, but are significantly more expensive than pressurized microfiltration. For these reasons, microfiltration was not considered cost effective. Based on the various obstacles that would impact the use of microfiltration, it has been determined the most cost effective system should utilize conventional gravity filtration. The following sections describe the filtration facilities and all of the components of the filters, including the media, the underdrains, air scour system, filter to waste system, the filter backwash sequence, and the process controls needed for the filters.

6.5.3.1 Gravity Filtration

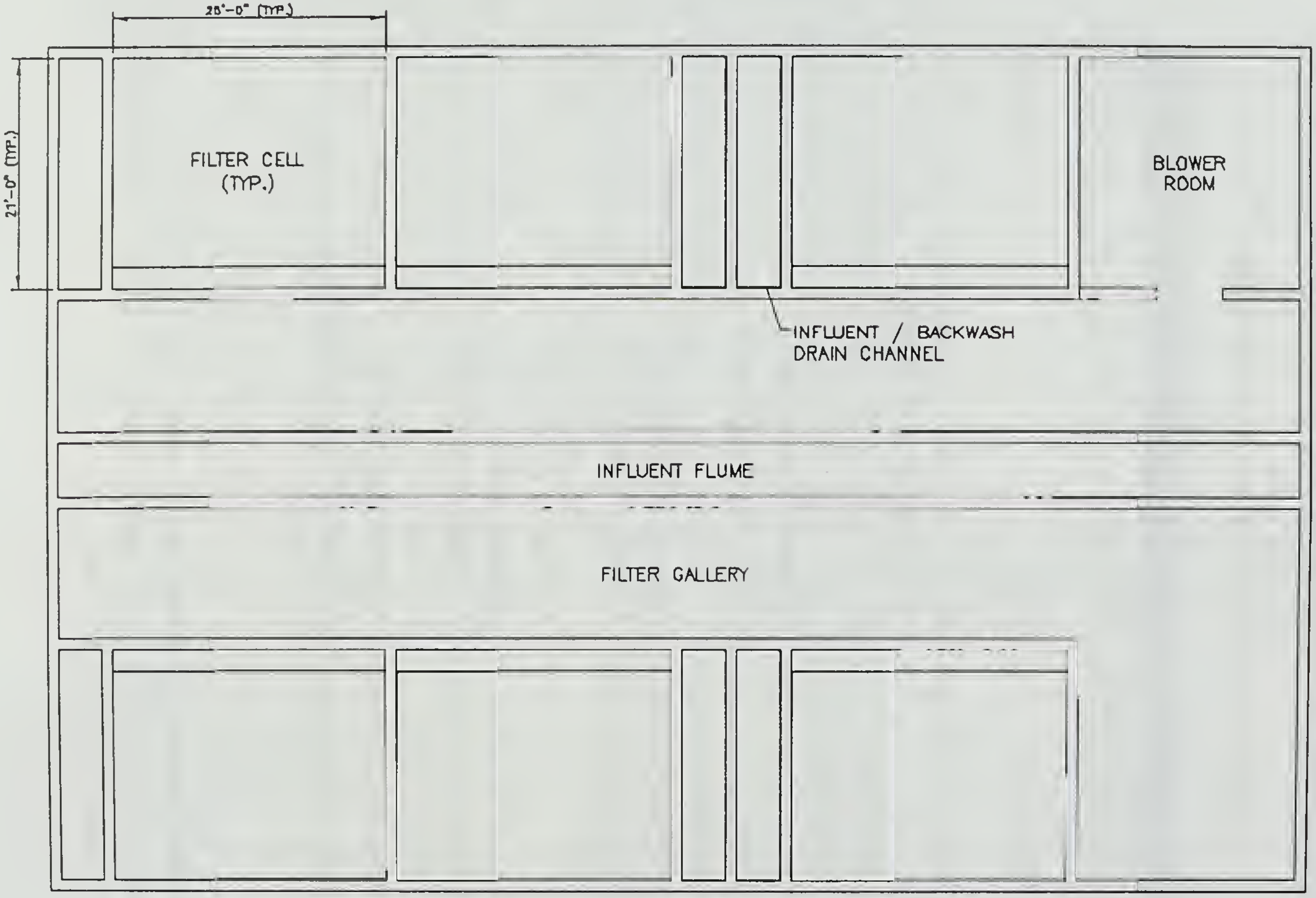
Conventional treatment, following sedimentation pretreatment, normally employs gravity filtration. Typical gravity filters are loaded at a maximum rate of 5 gpm/sf. Six filters would be provided to meet the 21.0 mgd production requirement. Each filter would be 600 square feet. Three filters would be constructed on each side of a pipe gallery (See Figure 6-12 for an overall layout). Typical system design criteria and preliminary design values are presented in Table 6-10.

TABLE 6-10
DESIGN CRITERIA FOR FILTER SYSTEM

Parameter	Design Criteria
Design Filter Production Rate	21.0 mgd
Filter Surface Area	
New Filters No. 1-6	600 sf
Total	3,600 sf
Filter Box Depth	12 ft
Filter Media	(dependant on pilot testing)
Filter Underdrain Type	Plastic with porous plate (no gravel)
Backwash Supply Rate	
Loading Rate	20 gpm/sf (maximum)
Backwash Rate	12,000 gpm (maximum)
Filter Loading Rate	
All units online	4.0 gpm/sf (maximum)
One unit out of service	4.8 gpm/sf (maximum)
Air Scour Blower	
Capacity	3,000 scfm (maximum)
Drive Type	Variable speed
Air Scour Rate	5 scfm/sf (maximum)
Filter-to-Waste	
Loading Rate	5 gpm/sf (maximum)
Total Flow	3,000 gpm/filter (maximum)

6.5.3.2 Filter Media

The proposed filter media will be a dual media with layers of sand and anthracite; mixed media with layers of sand, anthracite and garnet; or deep bed mono media consisting of sand or anthracite. The media system used will be based on pilot testing.



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REGIONAL WATER SYSTEM
LOWER LEVEL FILTER BUILDING PLAN

FIGURE
6-12

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6.5.3.3 *Filter Underdrain*

The proposed filter underdrains will eliminate the need for support gravel below the media by using a porous cap and will have the ability to accommodate air scour. Underdrain modules would be rectangular shaped plastic laterals with dispersion orifices located in the top flat surface. The blocks have a tubular design with internal parallel counter balancing chambers hydraulically connected by a series of orifices that promote an even distribution of air and water over the filter area. The blocks are arranged end-to-end and have gasketed, snap-lock joints, which are mechanically jointed together to form continuous underdrain laterals along the entire length of the filter bottom. The underdrain laterals collect and route the treated water to an effluent flume at the front of each filter.

6.5.3.4 *Filter Air Scour System*

Air scour involves the introduction of air at the beginning of the backwash cycle to assist in agitating the media to release trapped solids. Air and water run together briefly until the water level in the filter reaches the backwash trough, at which point, the air is shut off to prevent potential loss of media into the trough. The selected underdrain system will need to evenly distribute air across the entire filter bottom, ensuring an effective backwash.

Two blowers will be provided for the air scour system (one blower for standby). Actuated control valves will open/close to allow introduction of air to each filter. The blowers will be provided with VFD to allow adjustment of the airflow rate, and with an air flow meter used to automatically control the rate.

6.5.3.5 *Filter-to-Waste System*

Although Montana DEQ does not currently require Filter-To-Waste (FTW), it is anticipated it will be required in the future. The FTW system allows the rise in turbidity that occurs at the start of a filter run, referred to as filter ripening, to be passed to the waste handling system until the turbidity level drops to normal operating levels. The filter ripening often takes 15-30 minutes, and is when the filter is most vulnerable to passing pathogens. Providing FTW also allows the plant to dewater the filters to remove them from service. The FTW flow will normally discharge to the Recovery Pump Station to direct flow back to the head of the plant. As an alternative, flow can go to the backwash lagoons.

6.5.3.6 *Filter Backwash Sequence*

The filters will normally be backwashed based on high head loss, high effluent turbidity, or excess length of filter run. During normal operations, the water surface level will be maintained at a preset elevation over the top of the filter media, remaining constant by throttling the filter effluent valve during the filter run as solids accumulate on the media. When the end of the filter run has been reached, the unit will be backwashed by forcing air and water in reverse upward through the filter media.

At the beginning of the backwash cycle, the water level in the filter will be lowered to 6 inches above the media. Air scour will then be used to create high shear forces to break away solids deposited on the media. Next, the air-scour is combined with a low rate water backwash to further agitate and remove solids from the media. The concurrent air-water backwash is run until the water surface in the filter nearly reaches the level of the troughs, at which point the air is shut off to prevent the loss of media into the troughs. After the air scour is terminated, the backwash water is ramped up to a higher flow rate to fluidize the filter bed and flush out suspended solids into the backwash troughs, which carry the solids out of the filter box. Water used for backwashing will be pumped from the clearwell, using two pumps (one for standby).

6.5.3.7 Filter Process Control

The filters will be completely automated with programmable logic controllers (PLC). One PLC will control all of the filters, monitor filter activity, and sequence backwashes. Back-up controllers will be installed should the PLC be out of service. Instrumentation provided with the filters will include:

- Turbidimeters (filter influent, individual filter effluent, combined filter effluent, backwash waste water);
- Individual filter loss of head monitor;
- Filter influent channel water level;
- Individual filter water level;
- Individual filter effluent flow meter; and
- Filter control panels that will allow manual initiation of automatic backwash, manual wash using valve control switches, or complete manual operation of all valves.

6.5.4 Clearwell

Filter effluent will flow by gravity to a partially buried concrete clearwell. The clearwell will have two compartments with a baffle wall in each compartment. Normally, flow through the two compartments is in series as shown in Figure 6-13. Other options include flow through a single compartment or parallel flow. This option provides operational flexibility if either of the two compartments is down for maintenance. As a rule of thumb, clearwells are sized for about 10 percent of the peak day production or nominally 2 MG for the proposed water treatment plant.

6.5.5 Disinfection

The final step in the treatment process is disinfection. Both primary and secondary disinfection are required. Primary disinfection is used to meet the SDWA Contact Time (CT) requirements, while secondary disinfection is used to maintain a disinfectant residual in the transmission system. Primary disinfection can be done with chlorine, ozone, UV light, chlorine dioxide, or a combination of these. Ozonation and UV do not provide the required residual needed for secondary disinfection in the transmission system and would require alternative disinfection downstream. However, ozone or UV may be required in the future to meet upcoming regulations for providing a barrier to *Cryptosporidium*.

The raw water quality data for Tiber Reservoir indicates that chlorination would most likely create byproducts now regulated in the SDWA rule discussed previously. The high levels of TOC are indicative of DBP precursors that could significantly exceed the TTHM and HAA limits set by the Stage 1 DBP Rule. Chloramination secondary disinfection in lieu of chlorine is attractive for two reasons: 1) chloramines do not produce regulated disinfection byproducts to any significant degree, 2) chloramines are more stable and longer lasting than chlorine, providing better long term protection in the long transmission system pipelines, reducing or eliminating the need for disinfectant booster stations. For these reasons, chloramination is the recommended alternative for secondary disinfection. Chloramination takes place by combining chlorine and ammonia.

Chlorine will be added in the form of liquid sodium hypochlorite. Many new surface water treatment facilities have utilized liquid chlorination in lieu of gas. Storing and handling chlorine gas is a safety risk for operations staff, and the addition of chlorine gas scrubbers to mitigate this risk is very costly. In contrast, sodium hypochlorite is easy to store and handle with minimal safety risk. For these reasons, sodium hypochlorite is the recommended form of chlorine, with chemical metering pumps used to feed the treatment process.

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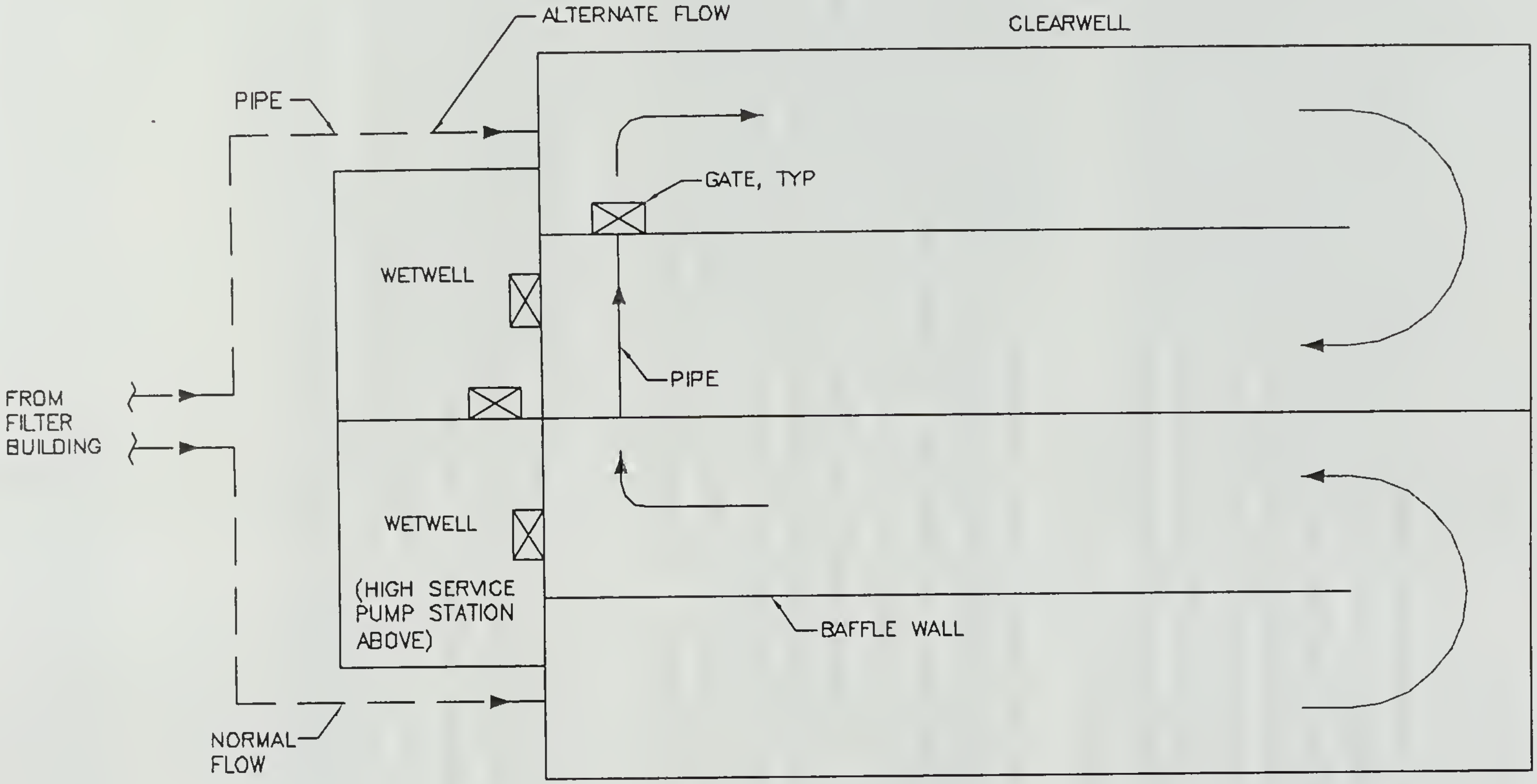

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REGIONAL WATER SYSTEM

CLEARWELL SCHEMATIC

FIGURE
6-13

The hypochlorite feed system will include schedule 80 PVC pipe and PVC diaphragm valves to minimize the corrosive effects. One Fiberglass Reinforced Plastic (FRP) storage tank will provide about a month of storage at peak chlorine demand. Typical solution strength is 12.5 percent. The tank will be fitted with vents and sample taps as appropriate. The tank will take smaller deliveries initially to limit storage time to a maximum of 30 days (sodium hypochlorite degrades over time). The chemical metering pumps will be located adjacent to the storage tank to minimize vaporization in the piping.

The ammonia feed system will be similar to the chlorine feed system with a FRP storage tank and two adjacent metering pumps. Typical ammonia solution strength is 33 percent. Chemical requests should specify a debris-free solution. Standard solutions typically contain debris that can cause maintenance problems. The ammonia tank will be sized to provide 30 days of storage at peak day doses or 20 percent more than a truckload. The tank will be fitted with an ammonia scrubber to keep vapors from escaping. Ammonia feed piping and valves will also be Schedule 80 PVC with a diffuser at the application point to ensure good mixing.

Chlorination will take place after pretreatment and prior to filtration. Adding ammonia after the clearwell, but before discharge to the transmission system, will keep the contact time for chlorine short enough to limit significant formation of disinfection byproducts. Good mixing is required to provide good contact between the disinfectant chemicals and the flow stream. PVC diffusers will be placed in the line between the pretreatment facilities and the filters and in the high service pump discharge to ensure thorough mixing.

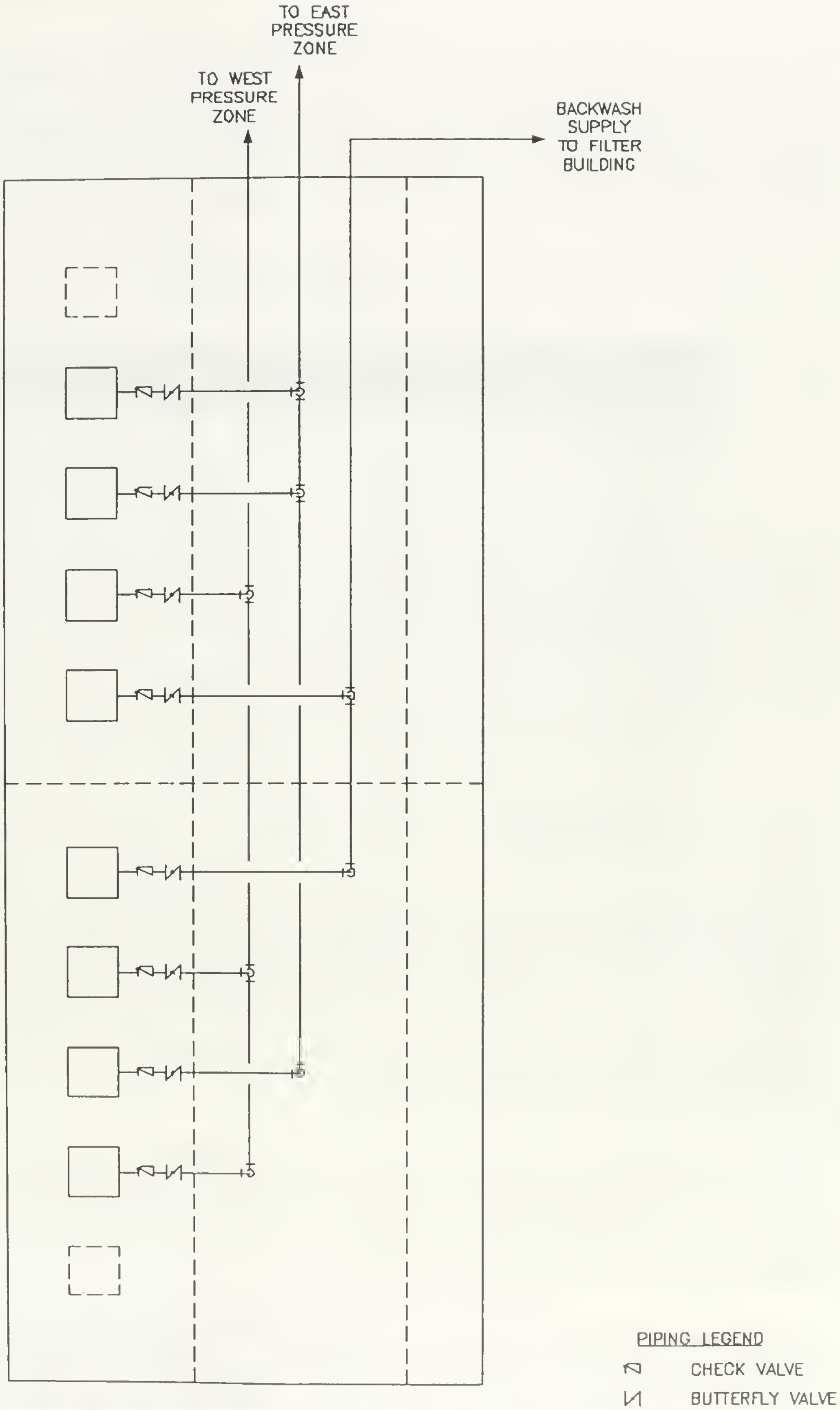
The design criteria for the disinfection system are summarized in Table 6-11.

TABLE 6-11
DESIGN CRITERIA FOR DISINFECTION

Parameter	Design Criteria
Chlorine:Nitrogen Ratio	3:1-5:1 (by weight)
Chlorine	
Dose	2-5 mg/L
Application Point	Before filtration
Form	12.5 percent NaOCl solution
Storage Volume	20,000 gallons
Metering pumps	2
Ammonia	
Dose	0.5-1.5 mg/L
Application Point	After the clearwell
Form	Debris-free aqueous solution
Storage Volume	5,000 gallons
Metering pumps	2
pH Range required	6-9

6.5.6 High Service/Backwash Pumping

The high service/backwash pump station will deliver water from the clearwell to the transmission system and provide flow to backwash the filters. The high service pumps and the backwash pumps will be vertical turbines, suspended into a wet well below the pump station. The pump station wet well will be connected to the clearwell (see Figure 6-13) with the wet well being several feet deeper to provide adequate pump submergence to allow the pumps to use the full volume of the clearwell. The wet well will be split with each side connected respectively to each side of the clearwell. Pumps for each service (east zone, west zone, and backwash) will be provided in both wet wells to allow pumping to continue if a wet well is drained for maintenance purposes. Each side of the wet well will be interconnected by a sluice gate. The high service pumps will pump into two pressure zones: east zone and west zone. The east zone will operate at about 67 psi with a peak demand of 8.48 mgd. The west zone will operate at about 148 psi with a peak demand of 11.50 mgd. Separate pumps will normally serve each pressure zone, although an interconnect will be included to dump water from the higher pressure zone to the lower pressure zone as additional backup. See Figure 6-14 for a schematic layout of the pump station.



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REGIONAL WATER SYSTEMS
HIGH SERVICE PUMP STATION

FIGURE
6-14

Pump sizing will be important to meet the required range of flows from start up to ultimate buildout in each zone. Three pumps in each zone would provide the flexibility to meet the range in anticipated flows. One small and one large pump in each zone would include a VFD to facilitate meeting the range in demands. One pump would be constant speed for additional reliability. Table 6-12 summarizes the high service pumps.

TABLE 6-12
HIGH SERVICE PUMPS

	Capacity, mgd	Drive-Type	Approximate Brake Hp
East Zone			
Pump 1	4.24	VFD	150
Pump 2	4.24	Constant	150
Pump 3	8.48	VFD	300
Firm Capacity	8.48		
West Zone			
Pump 1	5.75	VFD	250
Pump 2	5.75	Constant	250
Pump 3	11.50	VFD	500
Firm Capacity	11.50		

During initial startup of the water system when water demands are low, pump operations may require on/off operations until average demands reach about 2 mgd. The proposed smaller pumps with a VFD would be able to reduce output to around 1.7 and 2.2 mgd respectively, which would exceed possible start up flows of 0.9 mgd. Another option would be to install one small pump for each zone that has 2 mgd of capacity and replace it with a larger pump later. A 2-mgd pump could adjust down to about 0.8 mgd.

The backwash pumps will also be located at the High Service Pump Station. These pumps will be sized to meet the peak backwash rate of 20 gpm/sf or 12,000 gpm. Two pumps will be provided for redundancy and will each have a VFD to provide lower flowrates during the beginning and end of the backwash sequence.

As indicated previously, the pumps will be divided between the wet wells. The setup of the wet well with the clearwell will permit one side of the clearwell to be taken down without taking down one of the wet wells. Skylights will be provided to remove a complete pump assembly and a bridge crane will be provided to remove motors and pumps one piece at a time.

6.5.7 Chemical Facilities

The chemicals could be stored and used on the water treatment plant site:

- Aluminum Sulfate (Alum)/Ferric Chloride (Ferric)
- Caustic soda (sodium hydroxide)
- Powdered Activated Carbon (PAC)
- Chlorine Dioxide
- Coagulant Polymer
- Filter Aid Polymer
- Fluoride
- Sodium Hypochlorite (chlorine)
- Aqueous Ammonia (ammonia)

All chemical storage facilities will be located in a single chemical storage building, with separate areas provided for each chemical. If all the listed chemicals are required, the building would be approximately 13,000 square feet (150 feet by 90 feet), and would be well insulated to provide stable temperatures for chemical storage. The building would be fitted with ventilation and fire protection systems to meet health and safety standards as required. Chemical storage facilities will be located/graded to prevent direct drainage to the Marias River/Tiber Reservoir.

In addition, worker safety must be considered for access to facilities that will require maintenance (i.e., lights, valves, pumps, etc.) and in separation of incompatible chemicals (e.g., acids separate from bases, dry separate from liquid). Worker contact with chemicals will be minimized as much as possible with the use of machinery (e.g., forklifts, hand trucks, etc.). Special clothing, emergency showers, and eyewashes will also be provided. Secondary containment will be provided where appropriate.

Table 6-13 summarizes the chemicals used, the purpose of the chemical, and the application point.

TABLE 6-13
CHEMICAL FEED SUMMARY TABLE

Chemical	Purpose	Application Point
Alum/Ferric	Coagulant aid	Upstream of Pretreatment
Caustic	pH adjustment	Upstream of Pretreatment Upstream of the Clearwell
PAC	Taste and Odor control	Upstream of Pretreatment
Chlorine Dioxide	Pre-oxidation	Upstream of Pretreatment
Coagulant Polymer	Coagulant aid	Upstream of Pretreatment
Filter Aid Polymer	Improve filter performance	Upstream of Filtration
Fluoride	Reduce dental decay	Upstream of the Clearwell
Sodium Hypochlorite	Disinfection	Upstream of the Clearwell
Aqueous Ammonia	Disinfection	Upstream of the Clearwell

6.5.7.1 Alum/Ferric System

Alum is probably the most commonly used liquid chemical in water treatment plants because it is an effective coagulant aid. In liquid form, it is generally delivered in 48.5 percent strength. Ferric is also a common coagulant and is more effective over a wider range of pH than alum. It also works better in cold water temperatures and is more effective in TOC removal. Ferric is more difficult to handle than alum, as it is extremely corrosive and can accelerate deterioration of iron-based piping and valves. The type of coagulant recommended will be determined during the final design phase. Both alum and ferric would be delivered to the site in tanker trucks from 3,000 to 5,000 gallon tanks.

Liquid alum or ferric will be stored in two 7,000 gallon, FRP storage tanks. Two to four chemical metering pumps will be provided. The alum or ferric primary application point is the plant influent (rapid mix). Feed piping will be schedule-80 PVC with socket end joints and needle and ball valves where required.

6.5.7.2 Caustic Soda

Caustic soda will be used to adjust pH prior to pumping to the transmission system. Liquid caustic soda is typically delivered in 3,000-gallon tanker trucks. Recommended solution strength is 50 percent, which is the lowest cost concentration. Bulk caustic soda will be stored in a heated

5,000 gallon, FRP storage tank, adjacent to the alum/ferric storage. Two metering pumps will deliver caustic to the clearwell or the rapid mix. Piping and valves will be schedule 80-PVC.

6.5.7.3 *Powdered Activated Carbon (PAC)*

Powder activated carbon will be provided for taste and odor control and removal of TOC. Powder activated carbon will be delivered to the site to a 40,000 pound bulk truck delivery. The bulk PAC delivery will be pneumatically conveyed to slurry tanks, where solutions of 1 pound PAC per gallon will be created. The slurry tank will be fitted with a paddle mixer to keep the carbon in solution. From the slurry tank, PAC will be directed to a smaller day tank for dilution (with another paddle mixer) and two metering pumps will deliver the diluted slurry to the rapid mix and plant influent. PAC piping will be schedule-80 PVC with PVC diaphragm valves.

6.5.7.4 *Chlorine Dioxide*

Chlorine dioxide will be used for pre-oxidation of organics, iron, and manganese upstream of the rapid mix chamber. Chlorine dioxide was selected because it:

- Provides pathogen inactivation;
- Kills algae in raw water allowing easier removal in subsequent sedimentation;
- Improves filter performance; and
- Provides increased oxidation of seasonal iron and manganese that may be in the raw water; and
- By-products are not currently regulated.

Chlorine dioxide cannot be stored because it forms an unstable, explosive gas. Therefore, chlorine dioxide must be generated onsite. The generation process involves adding hypochlorous acid to sodium chlorite solution to lower the pH to between 2 and 3, then reacting with chlorine gas. This approach yields chlorine dioxide at a strength of about 90 percent. The solution is then diluted to the desired concentration and used for pre-oxidation.

6.5.7.5 *Coagulant Polymer*

Coagulant polymer will be used in combination with alum/ferric. Normally cationic polymers are used for this application. The feed system will consist of an FRP day tank where the polymer solution is manually batched or pumped as a liquid. Two metering pumps will deliver solution to the rapid mix.

6.5.7.6 *Filter Aid Polymer*

Filter aid polymer improves filter performance. Non-ionic and unionic polymers are normally used for this application. The filter aid polymer used may be dry or liquid. If dry polymer is chosen, a feeder and wetting unit-mixing tank and transfer pump will be provided. If liquid polymer is chosen, the system will duplicate the coagulant polymer system.

6.5.7.7 *Fluoride*

Fluoride is added to the water supplies of some communities to reduce dental decay. Fluoride is present at some level in all natural waters. A common optimal level of fluoride in drinking water for the prevention of dental caries is considered to be 1.2 mg/L. Fluoridation to achieve this optimal level can be very controversial in a community. The medical profession is almost always proponents of fluoridation. Usually there is faction of the community that sees fluoridation as adding a waste product in the drinking water and that at uncontrolled higher levels of fluoride, mottling of teeth and embrittling of bones can occur. The addition of fluoride will need to be a individual community decision. Appendix G includes a fact sheet on fluoridation.

If all communities desire fluoride addition, it will be added through the addition of sodium silicofluoride (dry), sodium fluoride (dry), or fluosilicic acid (liquid). Primary concerns with handling fluoride are operator safety and safe guards against overfeeding. Positive displacement metering pumps and break tanks are normal components to prevent overfeeding.

6.5.7.8 *Sodium Hypochlorite and Aqueous Ammonia*

Sodium hypochlorite and aqueous ammonia feed system are described in Section 6.5.5 Disinfection.

6.5.8 Residual Handling Facilities

6.5.8.1 *Pretreatment Residuals*

Solids generated in the pre-treatment process will be discharged to the sludge/backwash lagoons as shown in the process schematic on Figure 6-7. Two cells are provided to handle the solids generated. The cells would be used in alternating sequence, to allow time for solids to settle after each discharge and to take advantage of freeze-thaw dewatering of the sludge. Overflow from the lagoon cells will flow by gravity to a pump station that will direct flow back to the head of the plant.

6.5.8.2 *Backwash Waste Residuals*

Flow from the backwash wastewater drains in the filter building will flow by gravity to either the backwash lagoons or the backwash pump station. In the summer when flows are higher and the lagoons aren't subject to freezing conditions, it is anticipated that the backwash lagoons will be utilized. In the winter, when flows are smaller and the lagoons can be frozen, the backwash will be directed to the Recovery Pump Station to return flow to the head of the plant.

6.5.8.3 *Sludge/Backwash Lagoons*

The sludge/backwash lagoons will be earthen lagoons with concrete liner and ramps. Each sludge lagoon will be approximately 152 feet by 152 feet (2 MG capacity) and the backwash lagoons will be approximately 152 feet by 324 feet (5 MG capacity). The lagoons will be divided into four cells as shown on the site plan. The backwash cells will be able to receive filter-to-waste water as well as the backwash water. Decant from the lagoons will flow by gravity to a pump station to return flow to the head of the plant. Periodically, the lagoons will be scraped out with a loader and solids will be hauled to a landfill in dump trucks.

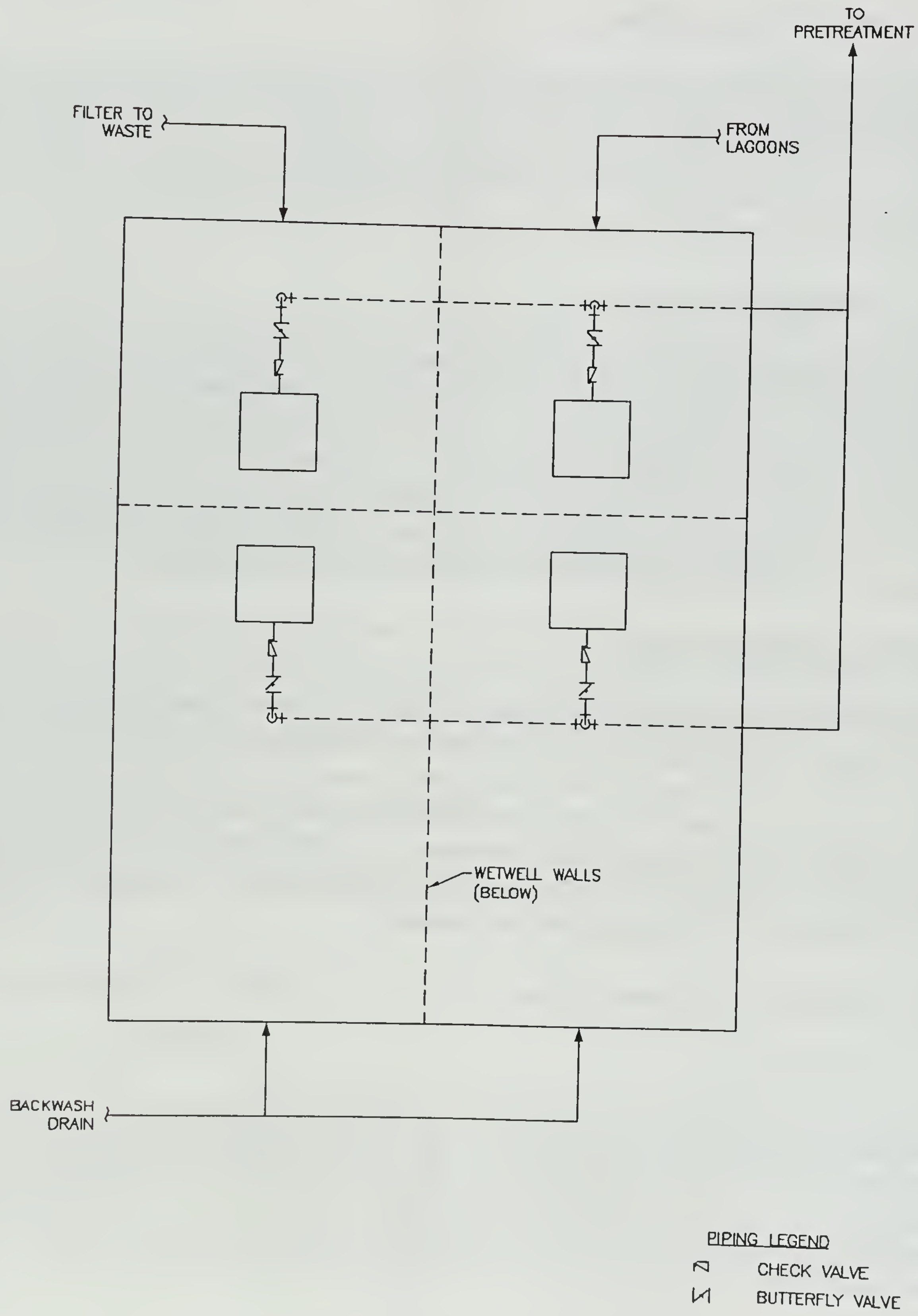
6.5.8.4 *Recovery Pump Station*

The recovery pump station will be a concrete wet well structure with a masonry building to house the equipment, located adjacent to the sludge/backwash lagoons. The pump station will have three wet wells: a backwash drain wet well, a filter-to-waste wet well, and a lagoon decant wet well as shown in Figure 6-15. The backwash drain wet well will be served by two vertical turbine pumps, one operating unit and one standby. The filter-to-waste wet well and the lagoon decant wet well will each be served by a single vertical turbine pump. The pumps will sit above the wet wells and will be enclosed inside the building.

6.5.9 Site Layout and Support Facilities

6.5.9.1 *Site Planning*

As mentioned previously, a proposed site plan for the intake/pump station and the water treatment plant site is presented in Figure 6-8. The site plan assumes raw water ponds would not be required. The chemical building is located adjacent to the access/entrance road to facilitate truck delivery of chemicals to the site. The maintenance, administration, and operations areas are also located close to the road for security reasons and to provide easy access for staff.



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HKM ENGINEERING

HDR Engineering, Inc.

ROCKY BOY'S / NORTH CENTRAL MONTANA
REGIONAL WATER SYSTEMS
RECOVERY PUMP STATION

FIGURE
6-15

6.5.9.2 *Administration/Maintenance*

The plant administration/maintenance building will be divided into two areas. In the administration area, a control room will contain all the plant Supervisory Control and Data Acquisition (SCADA) systems for the operators to monitor and control facilities at the plant. The SCADA system for the transmission system will also be located at the water treatment plant. However, the transmission system SCADA will operate separately from the SCADA system for the water treatment plant. In addition, a lab to process regular samples, restrooms, a lunchroom and a locker room will be provided in this area. An area for document storage and an office for the chief operator will also be included. The administration area will be approximately 3,000 square feet.

The maintenance area will include an open area for maintenance of plant equipment and two drive-through maintenance bays. The estimated size of the maintenance area for the water treatment plant will be approximately 4,000 square feet. A maintenance area for the transmission system will also be located at the water treatment plant. This area will include space for transmission system operation and maintenance vehicles and a "bone yard" for stockpiles of pipe materials and other appurtenances.

6.5.9.3 *Emergency Power*

The reliability of the water treatment plant is critical since the system users will rely on the plant as their sole source of water. Ten States Standards requires standby power to provide the average day demand. The average day demand for this facility, once all member water systems are on-line, will be approximately 6 mgd. Not all facilities at the water treatment plant, intake, or intake pump station need standby power. However, the following facilities are recommended for standby power service:

- (2) Intake pumps;
- (1) Train of pretreatment;
- (2) Filters;
- (1) Backwash pump;
- (1) Air scour blower;
- (2) High service pumps;
- Heating and ventilation facilities;
- Chemical feed facilities;
- PLC/SCADA system; and
- Emergency plant lighting

This power load may be met by installing generators at both the intake pump station and at the water treatment plant site. The generators would be diesel powered units with sufficient fuel storage for 48 hours of operation. This will require routine exercising of the generators to use the fuel to avoid storing the diesel fuel past its 6 month shelf life. Diesel fuels will be contained to prevent direct drainage to the Marias River/Tiber Reservoir.

6.5.9.4 Plant Domestic Wastewater

Wastewater generated by the plant operating staff will be directed to a septic system located on the water treatment plant site. A leach field will be provided as part of the system.

6.5.9.5 Security

Security has become a critical element of water treatment plant design in the wake of the September 11, 2001 terrorist attacks. Existing water system managers are currently taking a look within their organizations to define and characterize potential threats to their systems. Water systems serving over 3,300 and less than 50,000 people must complete a water system vulnerability assessment prior to June 30, 2004. A typical water system vulnerability assessment may consist of a system review, site characterization, development of a Security Improvement Plan, and update of an emergency response plan.

The Rocky Boy's/North Central Montana Regional Water System is not currently required to develop a water system vulnerability assessment. However, security improvements that are being implemented in other water systems will also be implemented at the Rocky Boy's/North Central Montana Regional Water System water treatment plant. These security measures will help to limit potential threats that could compromise the quality and reliability of the water leaving the water treatment plant. In addition, installation of security improvements during water treatment plant construction will prevent a necessary and expensive retrofit at a later date.

Types of security measures and countermeasures will include:

- Six-foot chain link fencing with barbed wire around the perimeter of the water treatment plant site;
- Closed-circuit television to monitor the raw water intake, pump station, and water treatment plant site from within the administration building;
- Controlled gate access to the water treatment plant site;
- On-site emergency power generation;
- Secure computer network firewall to prevent unauthorized remote access and corruption of the water treatment plant and transmission system SCADA systems; and

- Only authorized personnel will be allowed access to the intake/pump station structure. Access will be controlled with a locked gate.

6.6 ESTIMATED COST

The capital cost associated with each of the intake and water treatment facilities is summarized in Table 6-14. The total estimated field cost is $44 million (in October 2002 dollars). The cost includes an unlisted items allocation of 10 percent; mobilization/demobilization, taxes, bonds, and insurance of 10 percent; and contingency of 10 percent. The reduced cost when compared to the PER is due to elimination of the raw water/pre-sedimentation basins and reduction in costs associated with the modified intake. The most expensive project components are the filter building ($7.1 million), followed by the pretreatment facilities ($6.3 million), intake/raw water pump station ($5.8 million), and site/raw water pipeline ($5.8 million).

The following assumptions were used for the cost estimate:

- Filter Building includes construction of six filters, with filter to waste and air scour facilities;

- The geotechnical investigation will reveal acceptable material for microtunneling for the raw water intake and pump station; assuming two intakes, one 350 feet and one 250 feet long, 42- to 48-inches in diameter, and four vertical turbine pumps;

- Plate settling for pretreatment (worst case);

- Chemical addition facilities as previously described;

- High Service Pump Station includes eight vertical turbine pumps and the cost for the pumps, building and discharge header piping;

- Site work includes yard piping for the treatment processes, fire hydrants, sewer and septic tank, storm drainage facilities, site electrical and instrumentation, grading, asphalt, landscaping, and backup generation;

- Clearwell includes a two-compartment clearwell with a baffle wall and a wet well for the high service and backwash pumps;

- Waste ponds including two (2) 2-million gallon sludge ponds and two (2) 5-million gallon backwash ponds with concrete lining;

- Administration building includes space for two offices, a control room, a unisex bathroom, lunchroom, locker rooms, a laboratory, mechanical room, maintenance work area, and two maintenance bays;

- Recovery pump station includes two backwash recovery pumps, one filter to waste pump, and one pump for pond overflow; and

- Distribution system SCADA is included in the cost estimation for the distribution systems facilities.

TABLE 6-14
ESTIMATED OPINION OF RAW WATER INTAKE, PUMP STATION, AND WATER TREATMENT PLANT CAPITAL COSTS

	Major Field Item Cost	Unlisted (10%)	Subtotal	Mob./Demob. 10%	Contingency 10%	Total Field Cost
Intake & Pump Station	$4,426,000	$443,000	$4,869,000	$487,000	$487,000	$5,843,000
Site (include RW pipeline)	$4,429,000	$443,000	$4,872,000	$487,000	$487,000	$5,846,000
Pretreatment	$4,806,000	$481,000	$5,287,000	$529,000	$529,000	$6,345,000
Filter Building	$5,390,000	$539,000	$5,929,000	$593,000	$593,000	$7,115,000
Clearwell	$1,949,000	$195,000	$2,144,000	$214,000	$214,000	$2,572,000
High Service PS	$4,314,000	$431,000	$4,745,000	$475,000	$475,000	$5,695,000
Chemical Building	$3,858,000	$386,000	$4,224,000	$424,000	$424,000	$5,092,000
Recovery PS	$1,118,000	$112,000	$1,230,000	$123,000	$123,000	$1,476,000
Ponds	$1,637,000	$164,000	$1,801,000	$180,000	$180,000	$2,161,000
Administration/Maint.	$1,373,000	$137,000	$1,510,000	$151,000	$151,000	$1,812,000
WTP Total	$33,300,000	$3,331,000	$36,631,000	$3,663,000	$3,663,000	$43,957,000

6.7 CONSTRUCTION PHASING

Construction phasing of some of the components of the water treatment plant, and intake pump station may be beneficial for best use of project funding as it becomes available. Construction of improvements associated with providing full capacity from the water treatment plant may be postponed until additional water distribution facilities are constructed and the demands in the water system increase to levels where additional capacity becomes necessary. This type of phasing would allow more people to get water sooner in the project. An example of a phased construction strategy of treatment units and major equipment items is shown in Table 6-15. Secondary benefits of phasing and smaller treatment units could be improved flexibility and greater operation efficiency at lower demands. A more complete phasing strategy will be developed in the pre-design stages upon final selection all treatment process components.

TABLE 6-15
EXAMPLE – PHASED CONSTRUCTION STRATEGY

	Phase I		Phase II		Phase III	
	Unit Quantity	Rated Capacity mgd	Total Unit Quantity	Rated Capacity mgd	Total Unit Quantity	Rated Capacity mgd
Intake Pumps	2	5.2	3	10.4	4	21.0
Pretreatment Units	2	13.8	-	-	3	21.0
Filter Cells	4	13.0	-	-	6	21.6
Clearwell Chambers	1	N/A	-	-	2	N/A
High Service Pumps – East Zone*	-	-	2	4.3	3	8.5
High Service Pumps – West Zone	2	5.75	3	11.5	3	11.5

*East Zone can be served initially by gravity.

6.8 ADDITIONAL TECHNICAL INVESTIGATIONS

Several issues must be resolved prior to final design and construction of the water treatment plant and intake/pump station. These issues include the following:

- Pilot testing of the potential water treatment plant technologies;
- Detailed geotechnical investigation to determine microtunneling construction feasibility;
- Detailed topographic survey, including the reservoir bottom near intake; and
- Real estate easement or property acquisition for intake and water treatment plant facilities.

6.8.1 Pilot Testing

Pilot testing provides a means to review potential treatment technology alternatives' effectiveness in treating the unique characteristics of the Tiber Reservoir water supply. The pilot testing results can then be used to select an alternative treatment train for optimum performance of the water treatment plant. Using the pilot testing to finalize the treatment process selection will pay for itself by eliminating conservatism in the design that would be necessary due to the uncertainties associated with the water quality and treatability of the Tiber Reservoir water. Assistance should be provided to the Rocky Boy's/North Central Montana Regional Water System Coordinating Committee in conducting pilot plant testing to verify the feasibility of utilizing alternative treatment technologies, such as Kruger Actiflo or plate settling presedimentation alternatives and membrane filtration or conventional filtration. Pilot testing will be used to confirm the technological feasibility for these systems, identify key differences between the various systems that may impact the facility design and/or acceptance, obtain operational and water quality data required for state regulatory approval, and establish detailed specifications and design criteria for the selected treatment train.

The pilot testing should be conducted for a period of time long enough to allow the treatment alternatives to experience the seasonal changes in water quality expected at the reservoir. Individual treatment trains should be pilot tested in parallel under various water quality conditions. The respective vendors must provide proprietary systems under terms to be determined during development of the pilot-testing program. The test systems should consist of completely automated, skid-mounted test units, complete with all pumps, valves, and pressure and flow indicators required to allow automatic operation of the test units. Operator intervention will be required only to set initial operating conditions, monitor system performance (e.g., flows, pressures and filtrate water quality), and conduct chemical cleaning of the unit processes. Principle tasks of pilot testing include:

- Review Available Technology;
- Coordinate with Equipment Suppliers;
- Negotiate Agreements with Suppliers;
- Identify Installation Requirements;
- Develop Pilot Testing Protocols;
- Design and Construct Pilot Unit for Conventional Treatment Train;
- Provide Installation Assistance on Pilot Units;
- Provide Operational Assistance on Pilot Units;
- Collect and Review Operations Data;

- Coordinate with Pilot Unit Suppliers During Operation;
- Coordinate Nondestructive Tests;
- Conduct Peer Review;
- Assist with Shutdown of Pilot Units; and
- Provide Treatment Train Recommendations for Final Design.

6.8.2 Geotechnical Investigation

Prior to initiating design, the existing native soils and subsurface geology should be characterized, particularly at the reservoir intake. This information will be used in the selection of the final layout of the treatment process components and will confirm or deny microtunneling as a viable alternative for the construction of the raw water intake laterals. Principle tasks of a geotechnical investigation include:

- Characterize subsurface geology, including rock density
- Determine the maximum slope for site grading; and
- Assess the structural loading of native soils.

6.8.3 Topographic Survey

A detailed topographic survey is also necessary for final layout of the intake and treatment facility components. The topographic survey should include the area including and immediately surrounding the intake and water treatment plant sites, along the alignment of the raw water pipeline, near and surrounding the raw water pump station, and along the intake laterals at the surface. A detailed bathymetric survey, a survey of the reservoir bottom, should also be performed in the vicinity of the proposed intake to accurately determine the extent to which the intake laterals must extend into the reservoir. Principle tasks of a topographic survey include:

- Generate surface spot elevations;
- Develop digital terrain model and 2-foot elevation contours for the water treatment plant site and other proposed facilities;
- Generate bathymetric spot elevations;
- Develop bathymetric digital terrain model and 2-foot elevation contours for the vicinity of the proposed raw water intake to the existing dam; and
- Merge the two elevation data sources into a single, contiguous database.

6.8.4 Real Estate or Easement Acquisition

The water treatment plant, raw water pump station, and intake laterals are anticipated to be located on property currently owned by the federal government and maintained by the Bureau of Reclamation. An agreement should be negotiated with the federal government over the final ownership and maintenance of the raw water intake, raw water pump station and pipeline, and water treatment plant property. Sufficient land area should be obtained for proposed facilities, including access roads and site piping provisions. Of particular importance will be providing adequate buffer around the intake and plant facilities to maintain proper security and restrict public access.

7. PIPELINES, PUMPING, AND STORAGE

7.1 INTRODUCTION

The pipeline system for this project represents a significant portion of the overall cost of this project (over 50 percent). The overall system is comprised of the core system (from the water treatment plant to the Rocky Boy's Indian Reservation and the on-Reservation transmission system), and the non-core system (the transmission, pumping, and storage system to serve the non-tribal entities). The system will provide water to the Reservation and provide wholesale water to the participating communities, water districts, and colonies.

The piping, pumping, and storage system for the core and non-core systems are considered a transmission system rather than a distribution system. The distinction is that water is delivered to the Reservation and large wholesale consumers rather than to individual homes or buildings. Each individual community and water district will provide the distribution function for these systems. Additionally, each community and water district will be responsible for the operation and maintenance and billing for their respective systems.

7.2 DISPOSITION OF VE PROPOSALS AND ITEMS FOR FURTHER STUDY

The VE study completed for this project suggested a number of possible modifications to several areas concerning pipelines, pumping, and storage. The Accountability Report for the entire VE study is included in Appendix F. A brief summary of these VE proposals included the following:

- Several pipeline alignment changes. These were investigated and several of these alignment proposals were incorporated into the Final Engineering Report (FER) (Proposals 3B, 3C, 3E and 3F). Proposal 3A was rejected because once the duration of operation was modified to 24 hours per day, the cost savings for this proposal were negated. The reroute to the Riverview Colony (Proposal 3D) was rejected because it required an additional pumping station that actually increased the overall cost.
- Elimination of two pumping stations. Elimination of pumping station RG#9 was accepted because it did not raise system pressures significantly and reduced the project cost. The elimination of pumping station RG#8 was rejected because it raised system pressures (377 psi) well above the design criteria (200 psi) and did not significantly decrease project costs. The pumping stations were renumbered for this report. Therefore, refer to the VE Study, Accountability Report, or the Planning/Environmental Report for the previous numbering system.
- Design the transmission system for 24 hour per day operation. This proposal allowed many of the pumping stations and pipelines to be downsized thus significantly reducing costs. The biggest cost reduction came from reducing the majority of 30-inch pipe to 24-inch pipe.

The VE study also identified several items for additional study. As part of the FER, these items for additional study were investigated and the results of this investigation are as follows:

- Revise "C" values. Three sources were consulted to determine the established Hazen-Williams "C" factor for the coefficients for both PVC[4] [5] [6] and cement mortar lined steel and DIP.[7] [8] [9] Based on the three references, the "C" range is 140 to 150 for PVC and 130 to 140 for cement mortar lined DIP and steel. Therefore, the previously selected values of 140 for PVC and 130 for cement mortar lined DIP and steel represent the low end of the range of "C" values identified. Therefore, the values already utilized were considered to be conservative for use for the 50-year design life.
- Re-evaluate system storage requirements. Each community and water district will have its own peaking storage. Therefore, it was decided to provide storage equal to half of the average day demand in the design year distributed throughout the transmission system. This amount of storage was selected to allow for repair and maintenance of the pipelines with minimal disruption of water service to the customers. Storage tanks are provided along transmission lines for the pumping stations to pump to and tank levels to control the operation of the pumps. This storage requirement dictates that 4.1 million gallons of storage be provided in the system.
- Reduction and distribution of the water losses. The water losses were identified at 15 percent in the previous feasibility and planning/environmental reports. With a new system, it was suggested that the losses be reduced to 10 percent of the total water produced. Water losses for each community and water district were included in their per capita water use and, therefore, were accounted for in those totals. Additionally, the water losses were redistributed based on the inch diameter per mile concept as suggested in the VE study. This modification to the methodology for distributing water losses is reflected in the pipeline sizing included in this chapter of the FER.

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[4] CertainTeed Corporation. *Friction Loss Characteristics,* Catalog Flier Code No. 40-22-15. Valley Forge, Pennsylvania. **C Value = 150**

[5] American Water Work Association (1980). *PVC Pipe – Design and Installation" AWWA Manual M23*, pp.48, Denver, Colorado. **C Value = 150**

[6] Walksi, Tomas M., Chase, Donald V., and Savic, Dragan A. (2001). *Water Distribution Modeling, First Edition*, pp. 37. Haestad Methods, Waterbury, Connecticut. **C Value = 142 to 147**

[7] American Cast Iron Pipe Company (1999). *American Pipe Manual, 18th Edition*, pp16-4. Birmingham Alabama. **C Value = 140 to 150**

[8] Ductile Iron Pipe Research Association (1984). Handbook *of Ductile Iron Pipe, 6th Edition*, pp.223, 229. Birmingham, Alabama. **C Value=130@60 years and 140 new**

[9] Nayyar, Mohinder L. (2000). *Piping Handbook, 7th Edition*, pp. C78. McGraw-Hill Handbooks, New York, New York. **C Value = 130**

7.3 DISCUSSION OF GENERAL DESIGN METHODOLOGY

The pipeline, pumping, and storage system was modeled using the PIPE2000 computer modeling software. The software completes the thousands of calculations required to compute the flows, head losses, and pressures for the data input and allows for alternative analysis to optimize the pipeline system. The ultimate goal of this modeling will be to satisfy the projected water demands while staying within the design parameters identified for the project in Chapter 4. The data required for the computer model includes the following:

- Average day water demands
- Peaking factors for the various communities and water districts
- Ground surface elevations for key components of the system (i.e. connection points to the existing water systems, pump stations, storage tanks, etc.)
- *Hazen-Williams* roughness coefficients for the different pipe materials utilized
- Pipeline routing

This data was used to create a system to be analyzed using the computer model and to optimize the pipe, pump station, and storage tank sizes and locations. The model allows the pipeline route, pipeline size, pump station location, pump station size (flow and discharge head), storage tank location and size to be varied to determine the most economical piping, pumping, and storage system based on the system requirements.

The following discussion describes the general methodology for developing the proposed piping, pumping, and storage system for all components of the system. Unless otherwise stated, these discussions apply to all components of the overall system core (on- and off-reservation) and non-core. The core (off-reservation) and non-core systems were developed as transmission systems based on the assumption that each of the communities, water districts, and colonies would have the storage facilities to provide the peak hour water demands. Therefore, the core (off-reservation) and non-core systems provide only peak day demands. The (core, on-reservation) system, however, was sized to provide the peak hour demands.

7.3.1 Sizing

Pipelines were sized to meet either peak day (core (off-reservation) and non-core systems) or peak hour (core (on-reservation system)) demands to municipal and rural systems over a 24-hour daily delivery period (Table 5-2). Pipelines sizes were selected through optimization of minimum energy input and smallest possible pipe diameter. Where excessive friction losses from high velocities cause low pressures, the pipe diameters were increased or pump stations added to increase pressures. If reduction of head loss through use of larger diameter pipe was not enough to maintain design pressures, pump stations were added and velocities were allowed to the 4-5 fps range. Utilizing the computer model, the pipe size and location and size of pumping stations were optimized to maintain the desired pressure range.

The North Central System is sized to minimize energy lost to friction and maintain a minimum residual pressure of 35 psi at any location at the design flow rate. A maximum design pressure of 200 psi was maintained in most cases unless higher pressures were cost effective to eliminate a pump station without excessively high pressure. Friction losses were calculated using the *Hazen-Williams* head loss formula using C = 140 for PVC pipes and C = 130 for cement mortar lined ductile iron or steel pipe. These coefficients were selected based on work sessions with the state and Reclamation and were verified through literature searches.

Transmission pipelines deliver water to the existing distribution systems of the entities participating in this project. Delivery pressures were selected that allowed filling of storage tanks of each distribution system. A maximum delivery pressure of 100 psi was selected. Pressure regulators will be provided, where necessary, to reduce delivery pressure to any individual users to approximately 50 to 60 psi.

7.3.2 Pipe Material and Corrosion Protection

The pipe material used will be selected during the final design process due to the actual locations selected for the pumping stations and storage tanks, analysis of the soil properties for corrosion potential, modeling of the final pipeline configuration for surge pressures, and pipe pricing just prior to the time of bidding the particular project and shall be consistent with Reclamation and industry standards.

7.3.3 Crossings/Land Acquisition

A field review of the proposed water system corridor was performed during July 1997. In addition, the following entities were contacted for information including right-of-way requirements, possible obstructions, and mitigation alternatives:

- Montana Department of Highways - Wetland Replacement
- Pike Construction Co., Chinook, MT - Materials, Crossings, and Obstructions
- Baltrusch Construction Co., Havre, MT - Materials, Crossings, and Obstructions
- Falls Construction Co., Great Falls, MT - Directional Drilling
- Patrick Construction Co., Havre, MT - Materials, Crossings, and Obstructions
- Hill County Roads, Jerry Olds - Materials, Crossings, and Obstructions
- Burlington Northern Railroad - Railroad Crossings and Rights-of-Way
- Morris River Electric Co. - Utility Crossings
- Montana Power - Utility Crossings

- Cenex Pipeline - Utility Crossings
- Havre Pipeline Co. - Utility Crossings
- Express Pipeline Co. - Utility Crossings and Rights-of-Way
- Three Rivers Telephone Co. - Utility Crossings and Rights-of-Way
- Triangle Telephone Co. - Utility Crossings and Rights-of-Way
- Air Force - Utility Crossings and Rights-of-Way
- Terracon Engineers, Billings, MT - Rights-of-Way
- County Commissioners - Rights-of-Way
- Brown Oil Company, Havre, MT - Rights-of-Way
- Montana Department of State Lands
- Bureau of Reclamation
- Bureau of Indian Affairs
- Bureau of Land Management
- Tribal Trust Lands (Turtle Mountain)

The results of this work project were utilized to estimate the costs associated with pipeline related crossings and the acquisition of land for project facilities.

7.3.4 Appurtenances

7.3.4.1 Non-Core and Core (Off-Reservation)

Isolation valves, air and vacuum valves and manholes, flush hydrants, and meter vaults are provided on the pipelines. The isolation valves provide locations to close off the individual sections of the network, isolating sections and providing a means to minimize water loss in the event of a water line break. The isolation valves also allow the line to be tested in sections as the system is constructed and phased into service. Because of the remote location, distance between communities, limited number of intersections, and generally consistent landscape, isolation valves are only provided at two-mile intervals for all of the pipe diameters.

Air and vacuum valves are provided to allow air to escape from high spots in the pipelines and/or draw air into the system to avoid a pipe collapse in the event of a sudden drop in pipeline pressure below atmospheric pressure. Even though much of the terrain for the region included in the core and non-core systems is relatively flat, the pipeline experiences many significant changes in grade. For this study, it is assumed air and vacuum valves are required for approximately every three miles of pipe.

Flushing hydrants provide a means to flush and drain specific sections of pipe. Hydrants are generally located at low points in the system between successive air and vacuum valves, and are used for disinfection and testing of the pipeline. For this study, it is assumed that flushing hydrants are required approximately every two miles on the core and non-core systems.

Meter vaults are required at each connection to a community, colony, or water district to meter flows. These meters will be installed in underground vaults at the point of connection and will include a radio transmitter to deliver the metering data back to the central operation and control facilities located at the water treatment plant. The pressure at the point of connection and instantaneous flow rate will also be transmitted. This feature will eliminate the need for a meter reading system for the major users on the system.

7.3.4.2 Core (On-Reservation)

Isolation valves, air and vacuum valves and flushing hydrants are also included in the core (on-reservation) system. The frequency of placement, however, is increased to account for the increased number of intersections, service connection locations and steep terrain. Because service connections are scattered throughout the system, greater flexibility is needed in isolating a section of pipe for repairs and/or maintenance. Thus, flushing hydrants are provided at approximately one mile intervals. The terrain on the Reservation is fairly steep with many hills and valleys. For this reason, air and vacuum valves and manholes are also provided on every mile of pipeline.

7.3.5 Pumping Stations

Pumping stations lift water to the service area and provide energy for pressurization. Pumping stations were sized to provide this hydraulic lift and to overcome pipeline friction losses. Storage reservoirs were strategically located along the transmission pipelines to optimize the performance of the pumping stations. The reservoirs eliminate the need for expensive variable frequency drives typically required on transmission mains with pumping stations in series.

Pumping stations were strategically located to provide the required hydraulic grade line to satisfy the design criteria for pressures. Each pumping station will be designed to meet the state's requirements for redundancy and will be sized to accommodate future disinfection facilities to boost levels to properly ensure adequate disinfection. As stated previously, the pump station sizing and locations were optimized using the computer model.

7.3.6 Storage

Storage volumes were set at one-half of the average day demand levels to allow for some amount of operational and emergency storage as identified in Section 5.3.4. This storage was distributed throughout the transmission system based on the amount of water demand on the individual pipelines. There was a base amount of storage located at the water treatment plant to facilitate changes in demand and subsequent production rates at the water treatment plant.

7.4 PIPELINE, PUMPING, AND STORAGE SYSTEM COSTS

7.4.1 Pipeline Unit Prices

The cost for pipelines represents a significant portion of the overall project costs. Therefore, the project cost is very sensitive to the unit costs applied for pipelines. The cost for pipelines can vary for a number of reasons including but not limited to, the price of materials (for PVC pipe, the cost for materials is tied to oil prices), the time of year, the amount of other construction work either ongoing or being bid in the region, and the location of the work to be performed in relation to the labor force. For these reasons, estimating pipeline prices for a particular project for a construction period of 10 or more years is not an exact science. Therefore, information developed from several sources was utilized in deciding on the unit pricing to use for the FER. Table 7-1 summarizes the unit prices utilized for the various sizes and pressure classes for this project.

7.4.2 Pumping Station Unit Costs

Pump station costs were based on cost curves developed from previous projects. Figures 7-1 and 7-2 show the cost curves for small and large pumping stations. Costs for both smaller pumping stations (150-900 gpm) and larger pumping stations (1,000-7,000 gpm) were based on total capacity. These cost curves were developed using actual bids for pump stations on the Mni Wiconi project in South Dakota. These cost curves were then indexed to 2002 prices to be consistent with the authorization legislation.

7.4.3 Storage Tank Unit Costs

Storage tanks will either be ground tanks or elevated tanks. Previous life cycle cost analysis has indicated that cast-in-place ground storage tanks are more cost effective than steel or prestressed concrete. While the initial capital cost for cast-in-place concrete tanks is higher, there is no need for any of the expensive repainting that is accompanied with steel tanks. Therefore, the costs for the ground storage tanks were assumed to be cast-in-place concrete tanks. HKM Engineering has extensive experience in construction of these tanks and therefore, has based the costs for the storage tanks on these past bid tabs on previous projects indexed to 2002 prices. Figure 7-3 shows the cost curve utilized for storage tanks.

TABLE 7-1
SUMMARY OF INSTALLED UNIT PIPE COSTS

	Unit Cost per Foot					
	Below 150 psi		150 to 200 psi		Above 200 psi	
Size (inches)	Core Unit Cost ($/lf)	Non-Core Unit Cost ($/lf)	Core Unit Cost ($/lf)	Non-Core Unit Cost ($/lf)	Core Unit Cost ($/lf)	Non-Core Unit Cost ($/lf)
4	$6.17	$3.80	$6.17	$3.80	$15.07	$12.70
6	$9.25	$6.40	$9.25	$6.40	$17.46	$14.62
8	$11.43	$8.21	$11.43	$8.21	$17.92	$14.69
10	$15.53	$12.21	$15.53	$12.21	$23.01	$19.69
12	$20.71	$16.41	$20.71	$16.41	$29.00	$24.71
16	$36.49	$34.15	$48.64	$46.29	$48.64	$46.29
20	$52.09	$48.58	$55.23	$51.71	$55.23	$51.71
24	$59.86	$56.35	$62.38	$58.86	$62.38	$58.86
30	$105.66	$99.80	$105.66	$99.80	$105.66	$99.80

FIGURE 7-1
PUMP STATION COST CURVE (0 – 81 HP STATIONS)
(OCTOBER 2002 COSTS)

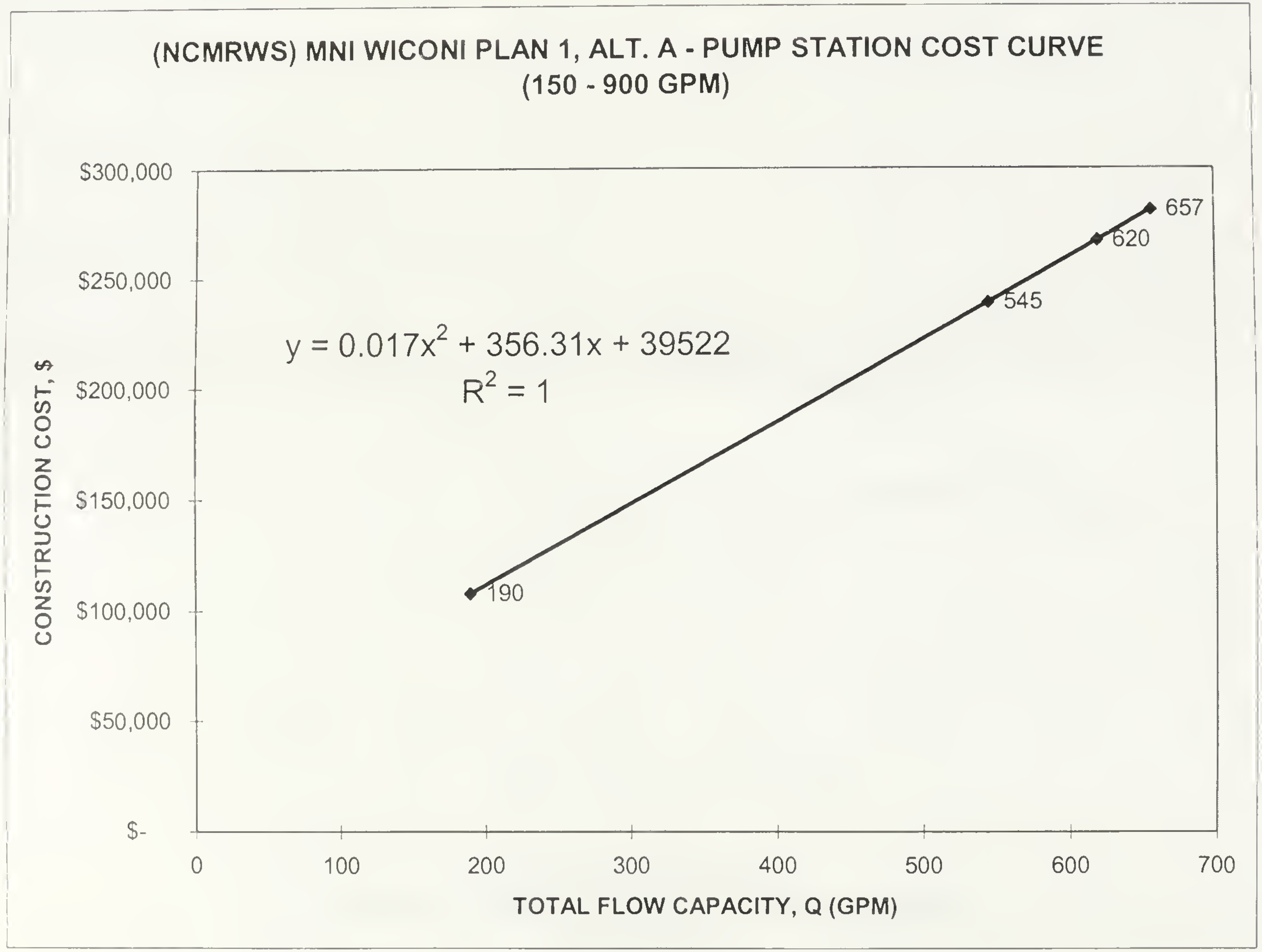
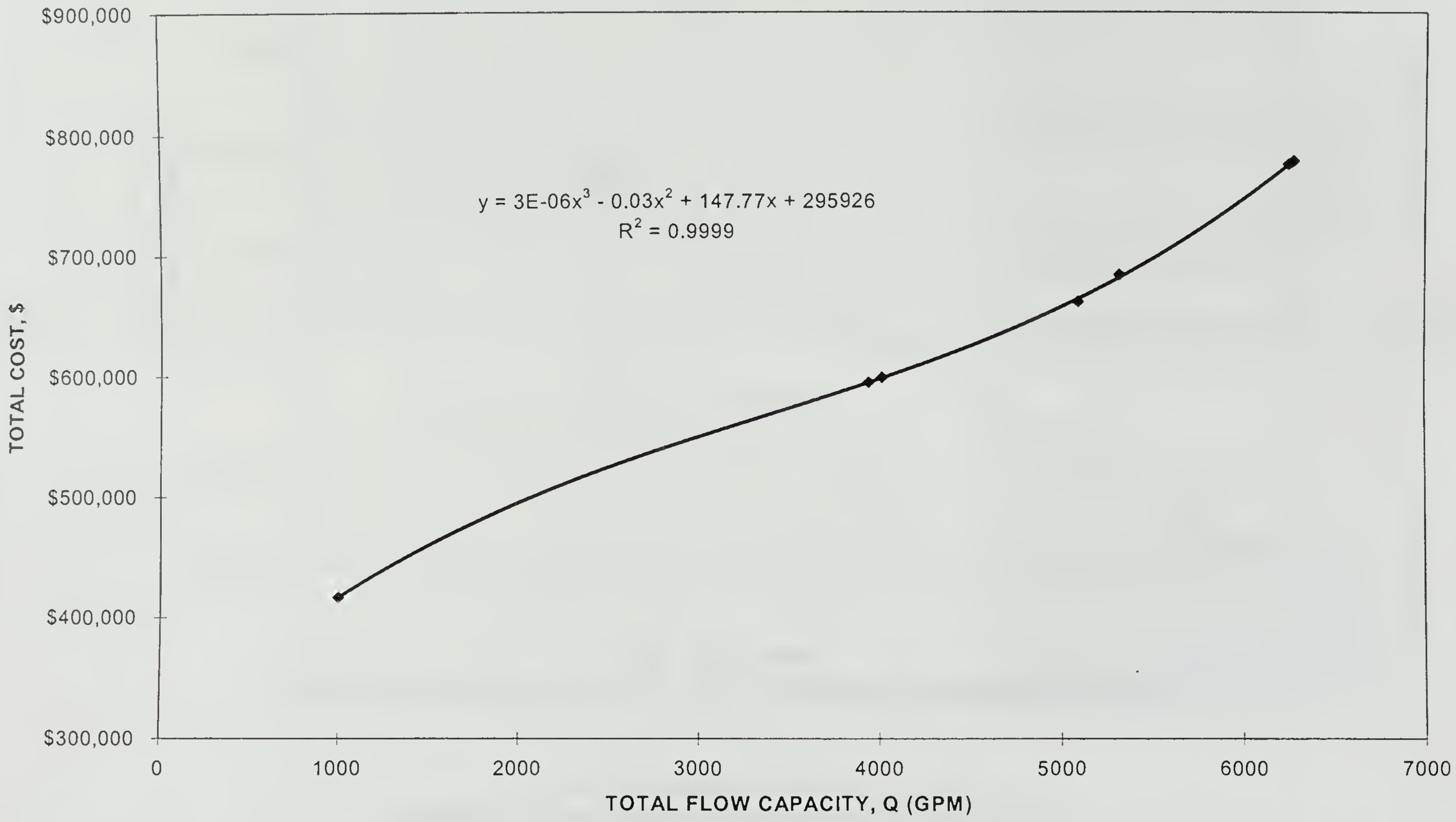
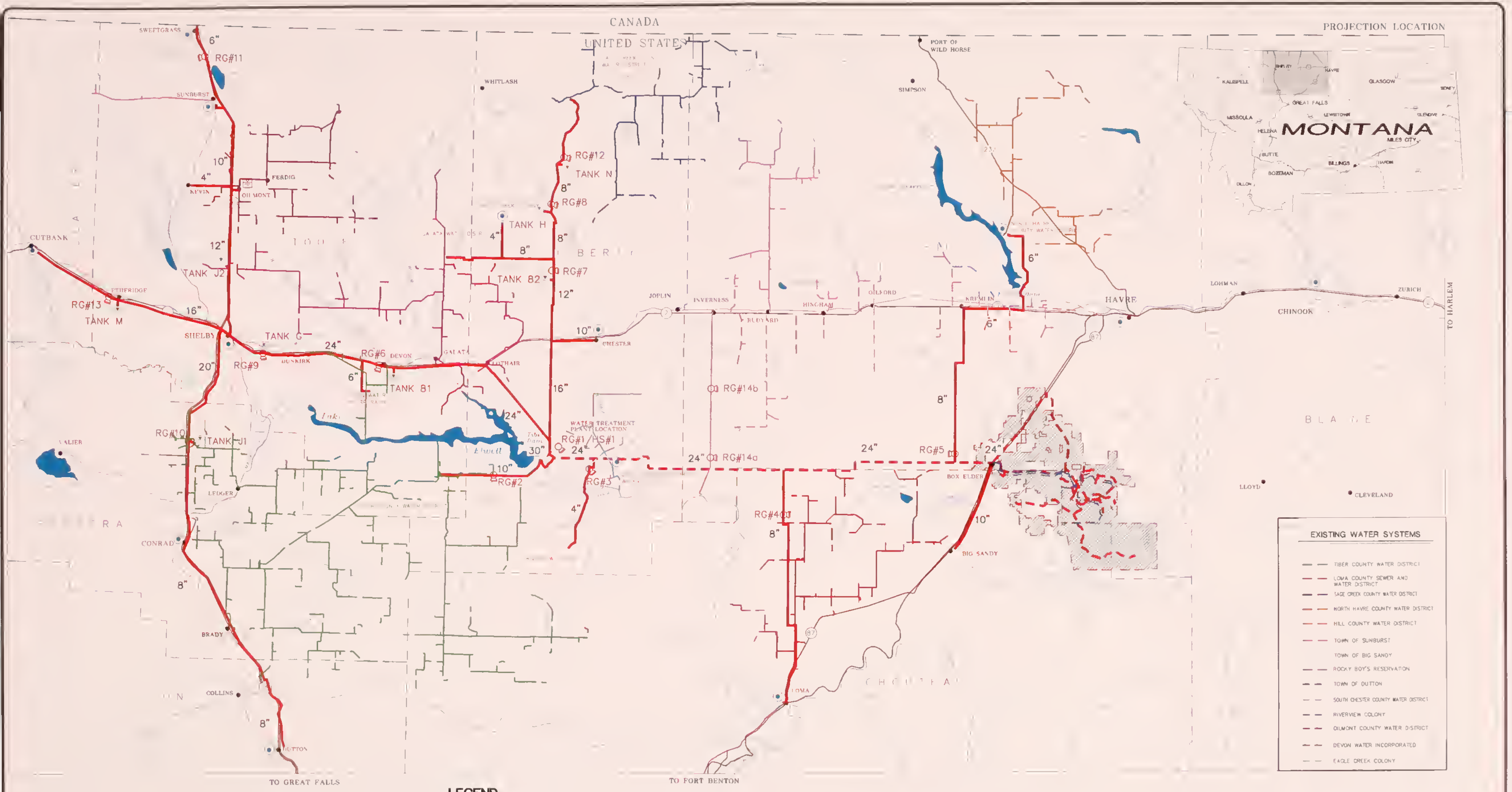


FIGURE 7-2
PUMP STATION COST CURVE (1000 – 7000 GPM)
(OCTOBER 2002 COSTS)





NOTE MOST CITY WATER SYSTEMS ARE NOT SHOWN ON THIS PLAN FOR CLARITY

LEGEND

—	ROCKY BOY INDIAN RESERVATION BOUNDARY	●	LOCATION OF CITY OR TOWN		RAILROAD
- - -	PROPOSED CORE WATER SYSTEM		PUMP STATION		RIVER AND STREAM LOCATIONS
—	PROPOSED NON-CORE WATER SYSTEM		COUNTY LINE AND NAME	HAVRE	POPULATION 10,000+
	PROPOSED WATER STORAGE RESERVOIRS			SHELBY	POPULATION 000 9,999
●	EXISTING WATER STORAGE RESERVOIRS		RESERVOIR LOCATIONS	KREMLIN	POPULATION 1 999
▾	PROPOSED REGIONAL WATER STORAGE RESERVOIRS		INTERSTATE HIGHWAY	HINGHAM	PARTICIPATING COMMUNITIES
			STATE HIGHWAY	LOHMAN	NON-PARTICIPATING COMMUNITIES
			OTHER ROUTES		

NORTH CENTRAL MONTANA
REGIONAL WATER SYSTEM COMPONENTS

FIGURE 7-4

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6M414.130 MAY 2004

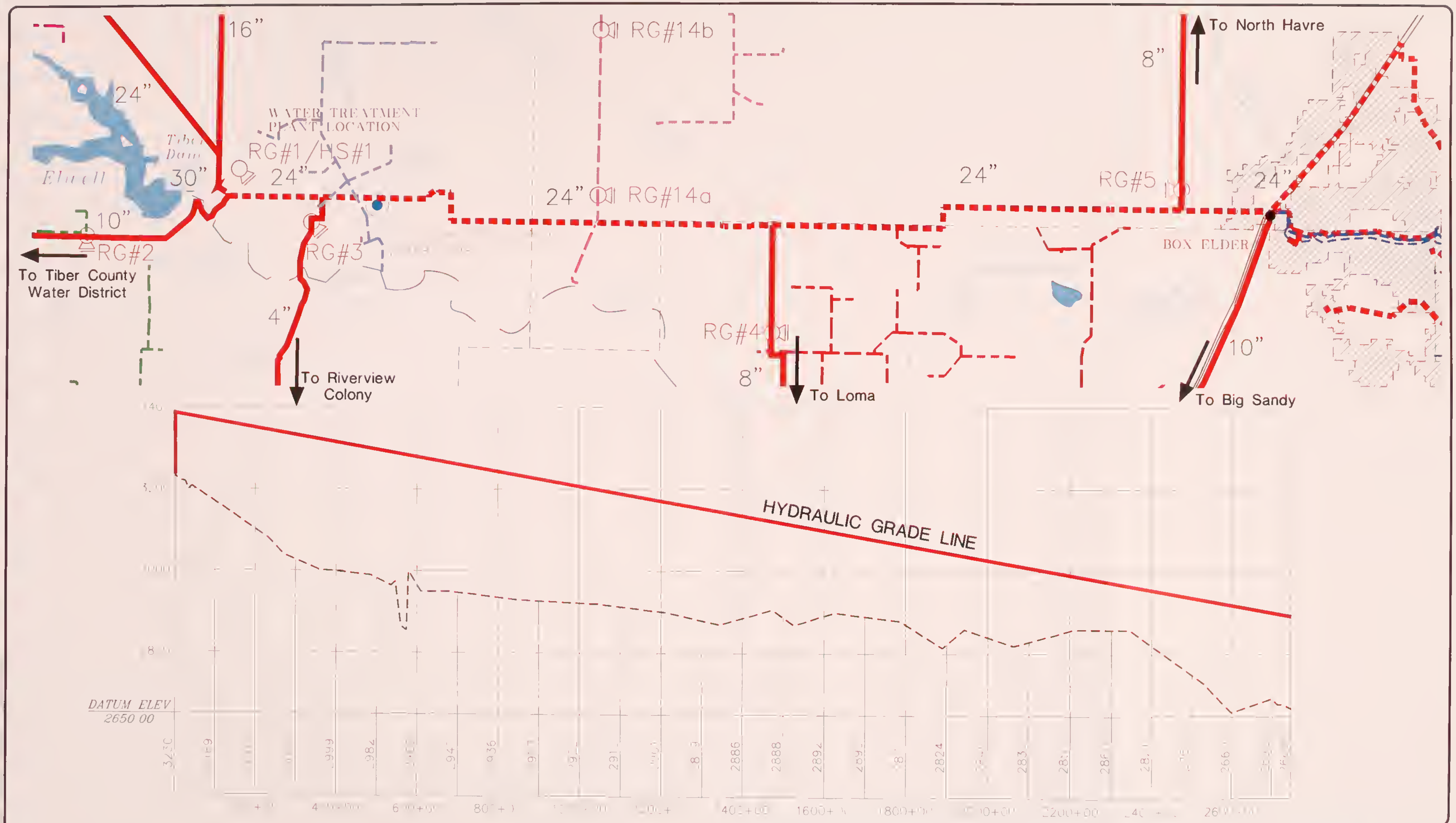
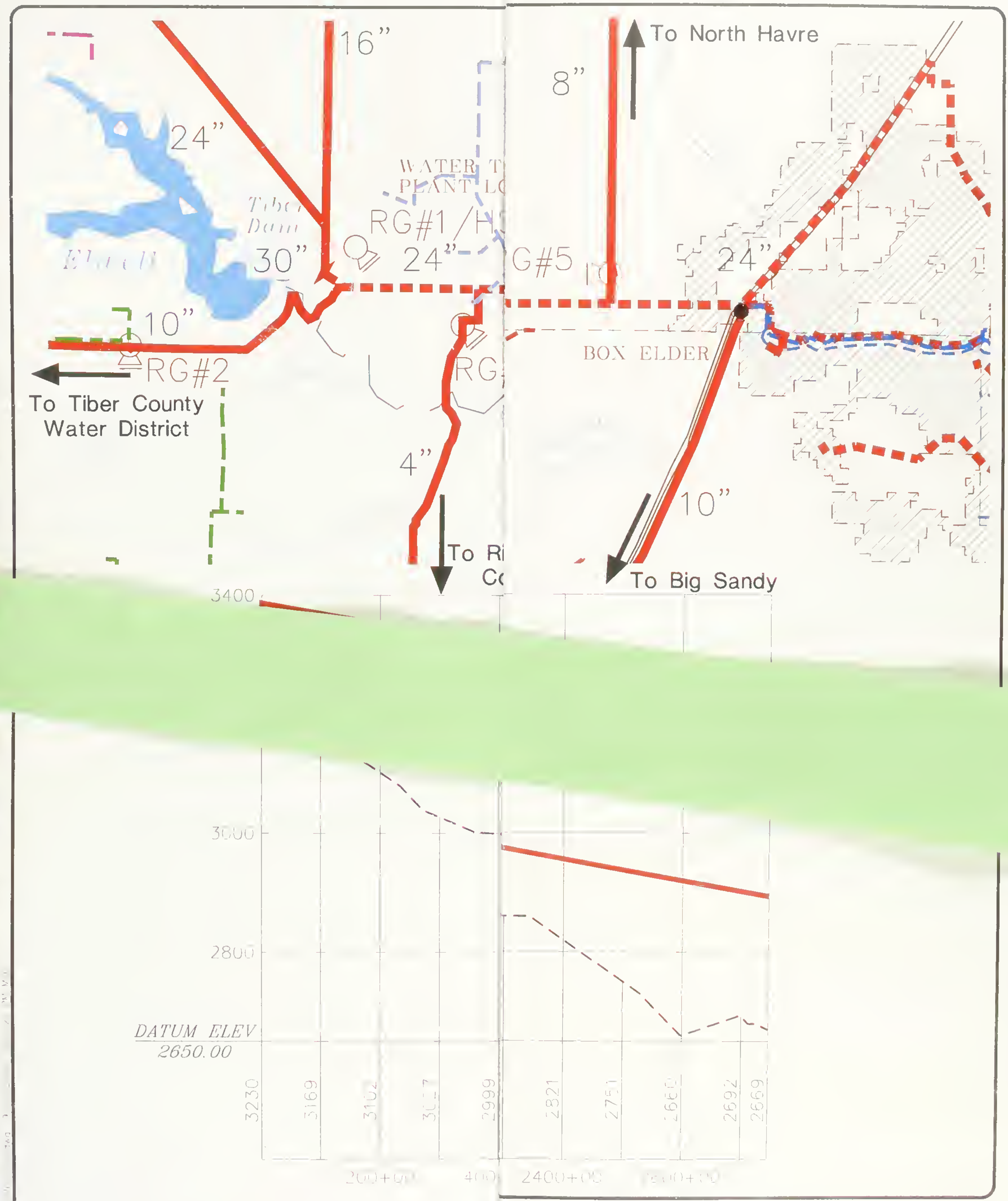


FIGURE 7-5

NORTH CENTRAL MONTANA
CORE BRANCH OF THE
WATER TRANSMISSION SYSTEM

HKM ENGINEERING
6M414.130 SEPT. 2003



ANA
E
STEM

FIGURE 7-5

HKM
ENGINEERING

6M414.130	SEPT. 2003

TABLE 7-3
SUMMARY OF TOTAL PIPE COSTS

	Total Cost (Material Plus Installation)								
	Below 150 psi			150 to 200 psi			Above 200 psi		
	Core	Non-Core	On-Res	Core	Non-Core	On-Res.	Core	Non-Core	On-Res.
Size	Total Cost	Total Cost	Total Cost	Total Cost	Total Cost	Total Cost	Total Cost	Total Cost	Total Cost
(inches)	($)	($)	($)	($)	($)	($)	($)	($)	($)
4	$0	$242,798	$0	$0	$115,493	$0	$0	$147,478	$0
6	$0	$1,113,009	$291,839	$0	$274,154	$169,033	$0	$0	$0
6	$0	$2,804,094	$228,941	$0	$1,364,191	$228,621	$0	$8,048	$0
10	$0	$2,376,019	$438,212	$0	$173,786	$156,619	$0	$0	$0
12	$0	$2,118,857	$1,486,836	$0	$0	$25,477	$0	$260,849	$0
16	$0	$3,592,672	$908,796	$0	$0	$221,687	$0	$3,440,272	$0
20	$0	$3,937,784	$949,753	$0	$0	$1,762,235	$0	$3,156,872	$0
24	$8,373,370	$6,015,052	$32,147	$8,431,969	$0	$0	$0	$6,710,055	$0
30	$0	$803,941	$0	$0	$0	$0	$0	$0	$0
Totals	$8,373,370	$23,004,226	$4,336,524	$8,431,969	$1,927,625	$2,563,671	$0	$13,723,574	$0

Total Core (Off-Reservation) System Pipeline Cost	$16,805,339
Total Non-Core System Pipeline Cost	$38,655,425
Total Core (On-Reservation) System Pipeline Cost	$6,900,195
Grand Total Pipeline Cost	**$62,360,959**

The pumping and storage associated with the core system are included at the water treatment plant site and are described in detail in Chapter 6. These facilities include the clearwell and the high service pumping to the east zone of the core system.

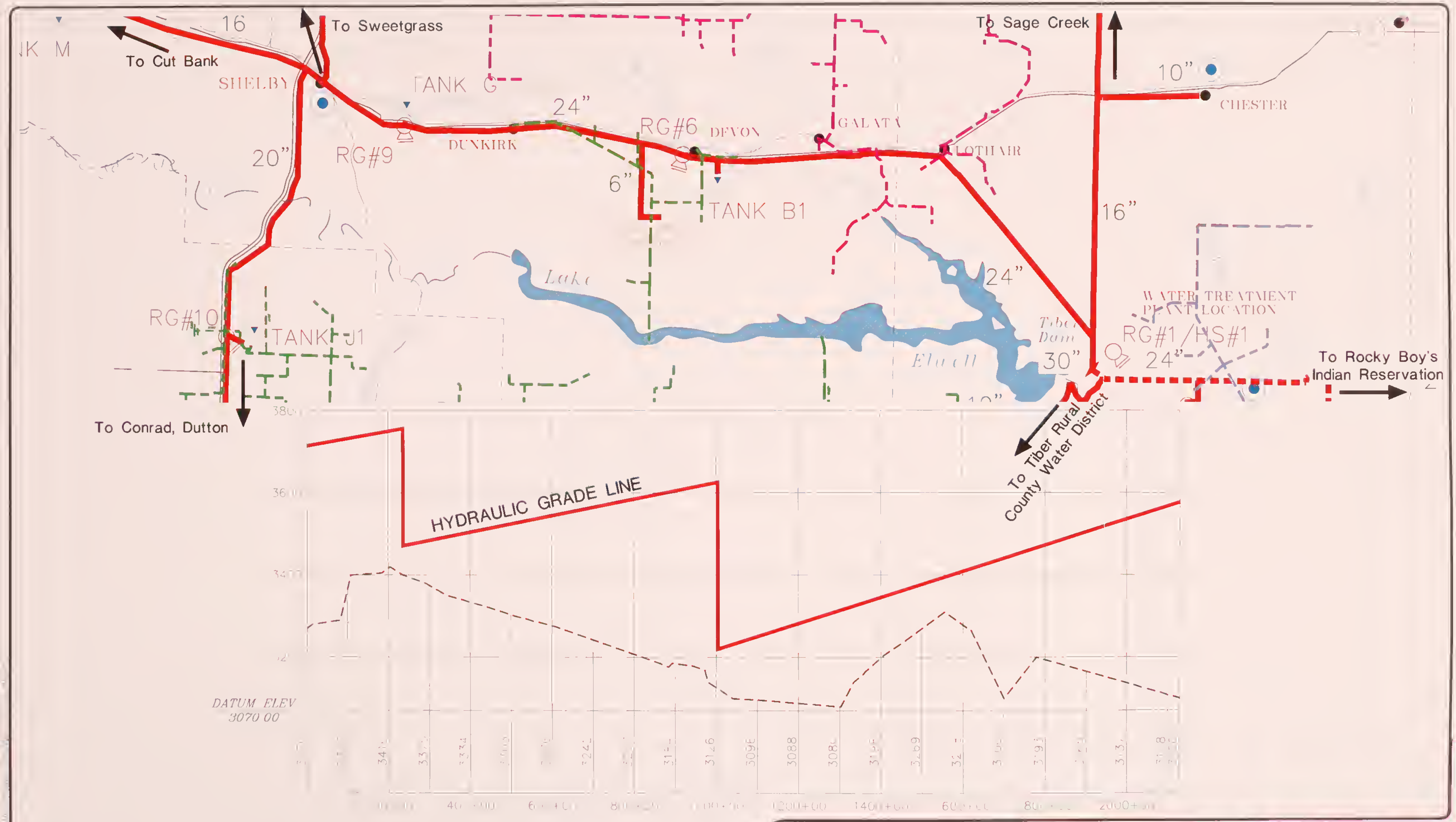
7.5.1.2 On-Reservation System

The Reservation water transmission system serves as the major transmission line between population centers (Figure 7-7). The water lines are sized to carry peak hour flows and peak day with a fire flow demand at the major population centers of Sangrey and Rocky Boy/Newtown. The specific demands for the system are identified in Table 4-2. The design criteria for the pipelines on the Reservation is the same as the regional pipelines with the exception of providing peak hour demands and fire flows. A discussion of peak hour and fire flow design criteria is included in Section 5.3.5. Pipe lengths by diameter are summarized in Table 7-5 and field costs are summarized in Table 7-6 for the reservation distribution system. A summary of the pumping stations and storage tanks recommended for the reservation system are included in Tables 7-4 and 7-5, respectively.

7.5.2 Non-Core System

All of the users to the north and west (Figure 7-6) are at higher elevations and require pumping to achieve the required pressures. This figure shows the plan and profile of the major non-core pipeline to the west. The total pipeline length for the non-core system is separated in Table 7-2 by size and pressure class. The storage and pumping system was laid out to provide a storage tank at the suction side of all major pumping stations. This storage system will provide a location to pump to for control and some amount of storage in each pressure zone for emergencies and maintenance.

A summary of the proposed non-core pumping stations is shown in Table 7-6 and includes the pressure zone, pump identification number, pump elevation, horsepower, rated flow (gpm), pump discharge pressure, and field cost. The pumping stations were located to keep pressures within the design range of 35 to 200 psi. Table 7-7 summarizes the pertinent size and configuration parameters of the recommended storage tanks. This table includes the pressure zone, storage tank identification number, capacity (gal), ground elevation, overflow elevation, field cost, and communities served.



NORTH CENTRAL MONTANA
NON-CORE BRANCH OF THE
WATER TRANSMISSION SYSTEM

FIGURE 7-6

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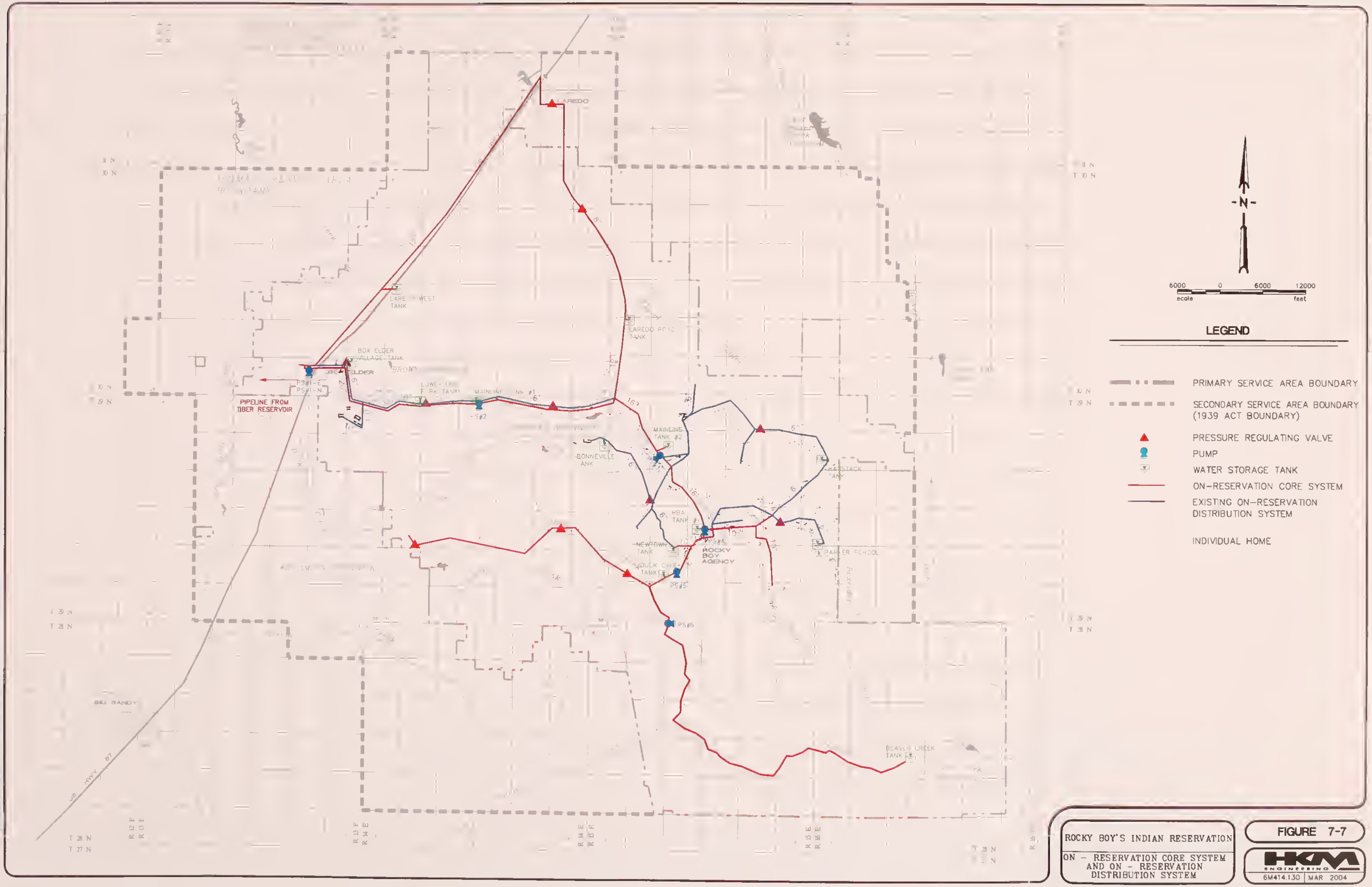

LEGEND

▬ · ▬ PRIMARY SERVICE AREA BOUNDARY

▬ ▬ ▬ SECONDARY SERVICE AREA BOUNDARY (1939 ACT BOUNDARY)

▲ PRESSURE REGULATING VALVE

● PUMP

▽ WATER STORAGE TANK

— ON-RESERVATION CORE SYSTEM

— EXISTING ON-RESERVATION DISTRIBUTION SYSTEM

INDIVIDUAL HOME

ROCKY BOY'S INDIAN RESERVATION

ON - RESERVATION CORE SYSTEM
AND ON - RESERVATION
DISTRIBUTION SYSTEM

FIGURE 7-7

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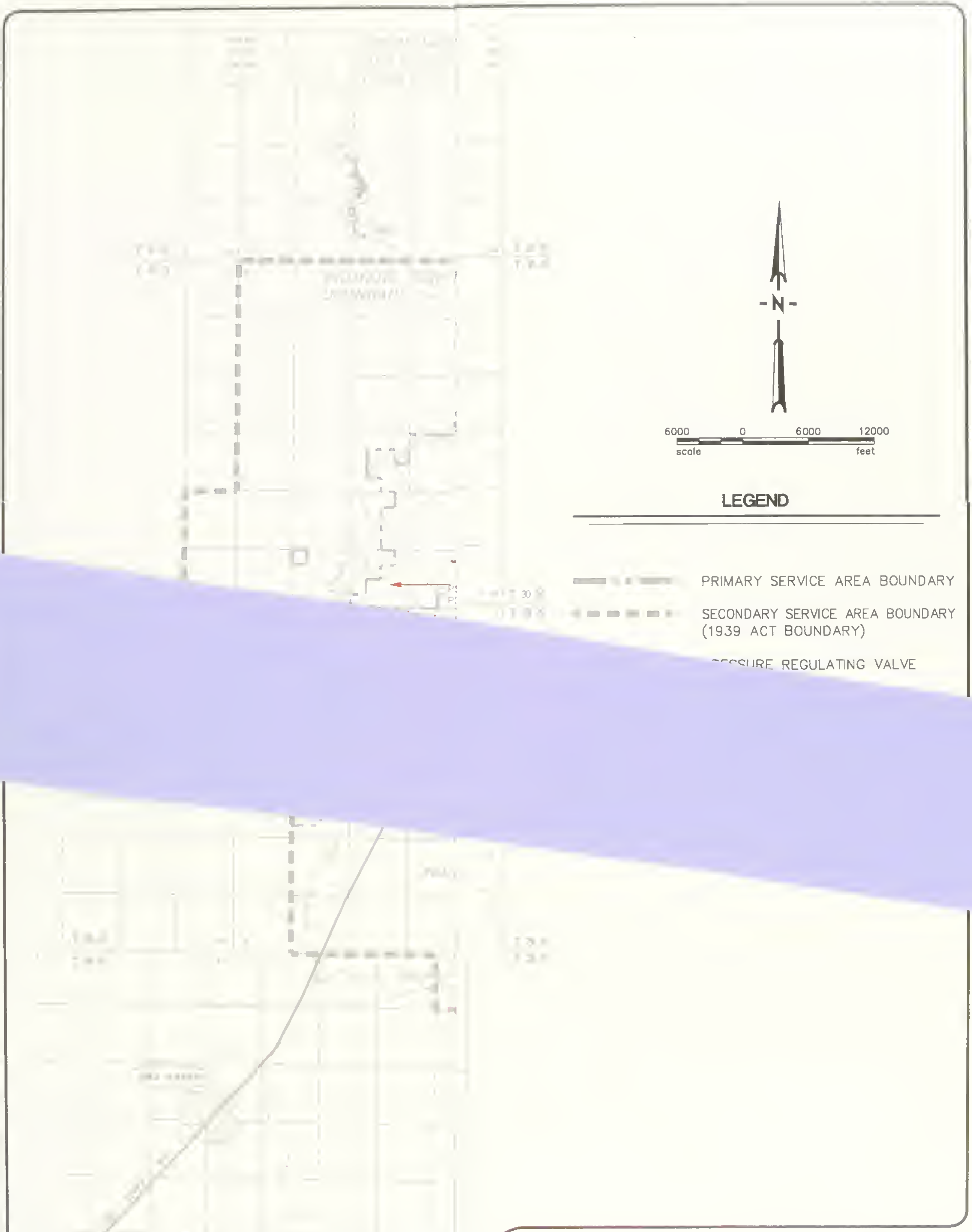

LEGEND

▬ ▬ ▬	PRIMARY SERVICE AREA BOUNDARY
▬ ▪ ▬ ▪	SECONDARY SERVICE AREA BOUNDARY (1939 ACT BOUNDARY)
	ESSURE REGULATING VALVE

ROCKY BOY'S INDIAN RESERVATION

ON - RESERVATION CORE SYSTEM
AND ON - RESERVATION
DISTRIBUTION SYSTEM

FIGURE 7-7

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TABLE 7-4 SUMMARY OF ON-RESERVATION PUMPING STATIONS

Pressure Zone	Pump	Pump Elevation	Water HP	Peak Day Pump Flow (gpm)	Pump Discharge Pressure (psi)	Field Cost
1	PS#1-E	2680	257	2562	207	$528,000
2	PS#1N	2680	24	1056	74	$435,000
3	PS#2	3000	309	2561	242	$528,000
4	PS#3	3360	151	1516	206	$461,000
5	PS#4	3700	117	1310	188	$445,000
6	PS#5	4020	9	196	112	$110,000
7	PS#6	1430	27	73	675	$66,000
Total			**893**			**$2,573,000**

TABLE 7-5 SUMMARY OF ON-RESERVATION STORAGE TANKS

Primary Pressure Zone	Tank	Percentage of Pressure Zone	75% of Peak Day Storage (gal)	Fire Flow Storage (gal)	Tank Capacity (gal)	Existing Tank Size	Ground Elevation	Overflow Elevation	Field Cost
1	Mainline Tank #1	14%	60,000	180,000	240,000		3060	3090	$479,000
1	Lwr DF	72%	330,000	-	330,000		2860	2920	$532,000
1	Box Elder Village	14%	70,000	0	70,000	69,000	2800	2830	Existing Tank Sufficient
2	Laredo West Tank	100%	1,140,000	180,000	1,320,000		2660	2810	$1,320,000
3	Laredo Road Tank	15%	100,000	30,000	130,000		3470	3490	$341,000
3	Mainline Tank #2	85%	570,000	150,000	720,000		3470	3490	$720,000
4	RBA Tank #1	100%	220,000	180,000	400,000	56,000	3800	3820	$552,000
5	Haystack Tank	39%	470,000	90,000	560,000	50,000	4100	4120	$576,000
5	Parker School Tank	11%	130,000	-	130,000	12,000	3980	4000	$341,000
5	Newtown Tank	36%	430,000	90,000	520,000	150,000	4100	4120	$570,000
5	Bonneville Tank	14%	170,000	-	170,000	40,000	3550	3560	$404,000
6	Duck Creek Tank	100%	130,000	180,000	310,000		4260	4285	$523,000
7	Bear Creek Tank	100%	80,000	180,000	260,000		5180	5210	$494,000
Total			3,900,000	1,260,000	**5,160,000**				**$6,852,000**

Notes: Assumes replacement of existing tanks if the capacity is less than half of the required tank size.

TABLE 7-6 NON-CORE PUMPING STATION SUMMARY

Pressure Zone	Pump	Model Pump	Pump Elevation	Water HP	Peak Day Pump Flow (gpm)	Pump Discharge Pressure (psi)	Field Cost
A	RG#1 (A)	E1	3235	145	5,889	45	Note 1
B	RG#1 (B)	W1	3235	675	7,999	149	Note 1
C	RG#2	TCWD	3050	45	606	225	$262,000
D	RG#3	RC	3130	1	32	140	$51,000
E	RG#4	Loma	2920	25	307	201	$151,000
F	RG#5	HCWD	2740	22	322	201	$156,000
G	RG#6	Pump-2W	3125	675	6,664	217	$836,000
H	RG#7	1-N	3390	25	402	150	$186,000
I	RG#8	2-N	3625	15	157	201	$96,000
J	RG#9	Pump-4W	3350	700	6,529	225	$817,000
K	RG#10	1-SW	3630	100	2,010	120	$496,000
L	RG#11	1-NW	3460	6	115	138	$81,000
M	RG#12	3N	3980	13	154	187	$95,000
N	RG#13	CB1	3550	200	1858	225	$486,000
(2)	RG#14a	InvernessP1	3010	28	380	160	$177,000
(2)	RG#14b	InvernessP2	3195	25	385	160	$179,000
Total				**2647**			**$3,713,000**

(1) Cost for the high service pumping station are included in the water treatment plant costs in Chapter 6.
Pump station RG#1 will include pumps that will pump into both pressure Zone A and pressure Zone B. The pressure zone is indicated by either (A) or (B) following the pump designation.

(2) Pumping Stations RG#14a and RG#14b will deliver water to the Hill County Water District through the existing Inverness pipeline.

TABLE 7-7 NON-CORE STORAGE TANK SUMMARY

Pressure Zone	Tank	Tank Capacity (gal)	Ground Elevation	Overflow Elevation	Field Cost
A	Clearwell	2,140,000	3240	3240	(1)
B	T-B1	620,000	3210	3435	$587,000
B	T-B2	140,000	3400	3495	$358,000
G	T-G	600,000	3350	3445	$583,000
H	T-H	40,000	3700	3715	$132,000
K	J1	130,000	3640	3715	$341,000
L	J2	10,000	3580	3715	$35,000
M	J3	210,000	3600	3715	$451,000
I	N	40,000	3720	3750	$132,000
Total		**3,930,000**			**$2,619,000**

(1) Cost for the clearwell storage is included in the water treatment plant costs in Chapter 6.

(2) Minimum Storage Tank Unit Cost is Assumed to be $1 per Gallon

TABLE 8-1 REGIONAL WATER SYSTEM PROJECT COST SUMMARY

INTEREST % 5.63
INFLATION % 3.00
YEARS 50

INDIAN(CORE) COMPONENTS NON-CONTRACT PERCENTAGE = 33%
NON INDIAN COMPONENTS NON-CONTRACT PERCENTAGE = 28%

	MAJOR FIELD ITEM COST $	UNLISTED ITEMS 10 %	SUBTOTAL	MOB./DEMOB TAXES, BONDS, & INS 10 %	CONTIN-GENCY 10 %	TOTAL FIELD COST $	NON-CONTRACT (% VARIABLE) $	TOTAL [1] PROJECT COST $
RAW WATER INTAKE, PUMP STATION, AND WTP COST								
Intake & Raw Water Pump Station	4,426,000	443,000	4,869,000	487,000	487,000	5,843,000	1,928,190	7,771,190
Site (includes raw water pipeline	4,429,000	443,000	4,872,000	487,000	487,000	5,846,000	1,929,180	7,775,180
Pretreatment	4,806,000	481,000	5,287,000	529,000	529,000	6,345,000	2,093,850	8,438,850
Filter Building	5,390,000	539,000	5,929,000	593,000	593,000	7,115,000	2,347,950	9,462,950
Clearwell	1,949,000	195,000	2,144,000	214,000	214,000	2,572,000	848,760	3,420,760
High Service Pump Station	4,314,000	431,000	4,745,000	475,000	475,000	5,695,000	1,879,350	7,574,350
Chemical Building	3,858,000	386,000	4,244,000	424,000	424,000	5,092,000	1,680,360	6,772,360
Recovery Pump Station	1,118,000	112,000	1,230,000	123,000	123,000	1,476,000	487,080	1,963,080
Ponds	1,637,000	164,000	1,801,000	180,000	180,000	2,161,000	713,130	2,874,130
Administration/Maintenance Buildin	1,373,000	137,000	1,510,000	151,000	151,000	1,812,000	597,960	2,409,960
SUBTOTAL	**33,300,000**	**3,331,000**	**36,631,000**	**3,663,000**	**3,663,000**	**43,957,000**	**14,505,810**	**58,462,810**
PIPELINES								
CORE PIPELINE (TIBER TO ROCKY BOY'S)	16,805,339	1,680,534	18,485,873	1,848,587	1,848,587	22,183,047	7,320,406	29,503,453
(NON-CORE) REGIONAL SYSTEM PIPELINES	38,655,425	3,865,543	42,520,968	4,252,097	4,252,097	51,025,161	14,287,045	65,312,206
(CORE) RESERVATION SYSTEM PIPELINES	6,900,195	690,020	7,590,215	759,021	759,021	9,108,258	3,005,725	12,113,983
SUBTOTAL	**62,360,959**	**6,236,096**	**68,597,055**	**6,859,706**	**6,859,706**	**82,316,466**	**24,613,176**	**106,929,642**
PIPELINES CATHODIC PROTECTION								
CORE PIPELINE	473,093	47,309	520,403	52,040	52,040	624,483	206,079	830,563
(NON-CORE) REGIONAL SYSTEM PIPELINES	952,274	95,227	1,047,502	104,750	104,750	1,257,002	351,961	1,608,963
(CORE) RESERVATION TRANSMISSION PIPELINES	127,631	12,763	140,394	14,039	14,039	168,473	55,596	224,069
SUBTOTAL	**1,552,999**	**155,300**	**1,708,299**	**170,830**	**170,830**	**2,049,958**	**613,636**	**2,663,594**
CROSSINGS/LAND AQUISITION								
CORE PIPELINE CROSSINGS	158,124	15,812	173,936	17,394	17,394	208,724	68,879	277,602
CORE PIPELINE R.O.W. AQUISITION	247,704		247,704			247,704	81,742	329,446
(NON-CORE) REGIONAL SYSTEM CROSSINGS	4,796,291	479,629	5,275,920	527,592	527,592	6,331,104	1,772,709	8,103,813
(NON-CORE) REGIONAL SYSTEM R.O.W. AQUISITION	1,606,279		1,606,279			1,606,279	449,758	2,056,037
(CORE) ON-RESERVATION SYSTEM CROSSINGS	600,095	60,010	660,105	66,010	66,010	792,125	261,401	1,053,527
(CORE) ON-RESERVATION SYSTEM R.O.W. AQUISITION	56,847		56,847			56,847	18,760	75,607
SUBTOTAL	**7,465,340**	**555,451**	**8,020,791**	**610,996**	**610,996**	**9,242,783**	**2,653,249**	**11,896,033**
APPURTENANCES								
CORE PIPELINE ISOLATION VALVES	222,759	22,276	245,035	24,503	24,503	294,042	97,034	391,076
AIR VAC/RELEASE VALVES & MHS	169,179	16,918	186,097	18,610	18,610	223,316	73,694	297,011
FLUSH HYDRANTS	157,103	15,710	172,813	17,281	17,281	207,376	68,434	275,810
(NON-CORE) REGIONAL SYSTEM - ISOLATION VALVES	366,409	36,641	403,050	40,305	40,305	483,660	135,425	619,085
AIR VAC RELEASE VALVES & MHS	665,403	66,540	731,943	73,194	73,194	878,332	245,933	1,124,265
FLUSH HYDRANTS	441,414	44,141	485,555	48,556	48,556	582,666	163,147	745,813
METER VAULTS	345,000	34,500	379,500	37,950	37,950	455,400	127,512	582,912
(CORE) RES. TRANS. SYSTEM - ISOLATION VALVES	73,510	7,351	80,861	8,086	8,086	97,033	32,021	129,054
AIR VAC/RELEASE VALVES & MHS	282,083	28,208	310,291	31,029	31,029	372,350	122,875	495,225
FLUSH HYDRANTS	113,197	11,320	124,517	12,452	12,452	149,420	49,309	198,729
METER VAULTS	15,000	1,500	16,500	1,650	1,650	19,800	6,534	26,334
SUBTOTAL	**2,851,057**	**285,106**	**3,136,163**	**313,616**	**313,616**	**3,763,395**	**1,121,918**	**4,885,313**
PUMP STATIONS [2]								
(NON-CORE) REGIONAL SYSTEM PUMPING								
RG#1 - High Service Pump Station (see note 4								
RG#2	262,000	26,200	288,200	28,820	28,820	345,840	96,835	442,675
RG#3	51,000	5,100	56,100	5,610	5,610	67,320	18,850	86,170
RG#4	151,000	15,100	166,100	16,610	16,610	199,320	55,810	255,130
RG#5	156,000	15,600	171,600	17,160	17,160	205,920	57,658	263,578
RG#6	836,000	83,600	919,600	91,960	91,960	1,103,520	308,986	1,412,506
RG#7	186,000	18,600	204,600	20,460	20,460	245,520	68,746	314,266
RG#8	96,000	9,600	105,600	10,560	10,560	126,720	35,482	162,202
RG#9	817,000	81,700	898,700	89,870	89,870	1,078,440	301,963	1,380,403
RG#10	496,000	49,600	545,600	54,560	54,560	654,720	183,322	838,042
RG#11	81,000	8,100	89,100	8,910	8,910	106,920	29,938	136,858
RG#12	95,000	9,500	104,500	10,450	10,450	125,400	35,112	160,512
RG#13	486,000	48,600	534,600	53,460	53,460	641,520	179,626	821,146
RG#14a	177,000	17,700	194,700	19,470	19,470	233,640	65,419	299,059
RG#14b	179,000	17,900	196,900	19,690	19,690	236,280	66,158	302,438
(CORE) RESERVATION TRANSMISSION PUMPING						-		
PS#1-1	528,000	52,800	580,800	58,080	58,080	696,960	229,997	926,957
PS#1N	435,000	43,500	478,500	47,850	47,850	574,200	189,486	763,686
PS#2	528,000	52,800	580,800	58,080	58,080	696,960	229,997	926,957
PS#3	461,000	46,100	507,100	50,710	50,710	608,520	200,812	809,332
PS#4	445,000	44,500	489,500	48,950	48,950	587,400	193,842	781,242
PS#5	110,000	11,000	121,000	12,100	12,100	145,200	47,916	193,116
PS#6	66,000	6,600	72,600	7,260	7,260	87,120	28,750	115,870
SUBTOTAL	**6,642,000**	**664,200**	**7,306,200**	**730,620**	**730,620**	**8,767,440**	**2,624,701**	**11,392,141**
STORAGE FACILITIES								
CORE SYSTEM STORAGE (See note 5)								
NON-CORE REGIONAL SYSTEM								
T-B1	587,000	58,700	645,700	64,570	64,570	774,840	216,955	991,795
T-B2	358,000	35,800	393,800	39,380	39,380	472,560	132,317	604,877
T-G	583,000	58,300	641,300	64,130	64,130	769,560	215,477	985,037
T-H	132,000	13,200	145,200	14,520	14,520	174,240	48,787	223,027
J1	341,000	34,100	375,100	37,510	37,510	450,120	126,034	576,154
J2	35,000	3,500	38,500	3,850	3,850	46,200	12,936	59,136
J3	451,000	45,100	496,100	49,610	49,610	595,320	166,690	762,010
N	132,000	13,200	145,200	14,520	14,520	174,240	48,787	223,027
(CORE) RESERVATION SYSTEM STORAGE								
Mainline Tank #1	479,000	47,900	526,900	52,690	52,690	632,280	208,652	840,932
Lwr DF	532,000	53,200	585,200	58,520	58,520	702,240	231,739	933,979
Box Elder Village (Existing	-	-	-	-	-	-	-	-
Laredo West Tank	1,320,000	132,000	1,452,000	145,200	145,200	1,742,400	574,992	2,317,392
Laredo Road Tank	341,000	34,100	375,100	37,510	37,510	450,120	148,540	598,660
Mainline Tank #2	720,000	72,000	792,000	79,200	79,200	950,400	313,632	1,264,032
RBA Tank #1	552,000	55,200	607,200	60,720	60,720	728,640	240,451	969,091
Haystack Tank	576,000	57,600	633,600	63,360	63,360	760,320	250,906	1,011,226
Parker School Tank	341,000	34,100	375,100	37,510	37,510	450,120	148,540	598,660
Newtown Tank	570,000	57,000	627,000	62,700	62,700	752,400	248,292	1,000,692
Bonneville Tank	404,000	40,400	444,400	44,440	44,440	533,280	175,982	709,262
Duck Creek Tank	523,000	52,300	575,300	57,530	57,530	690,360	227,819	918,179
Bear Creek Tank	494,000	49,400	543,400	54,340	54,340	652,080	215,186	867,266
SUBTOTAL	**9,471,000**	**947,100**	**10,418,100**	**1,041,810**	**1,041,810**	**12,501,720**	**3,952,714**	**16,454,434**
TELEMETRY								
CORE SYSTEM	100,000	10,000	110,000	11,000	11,000	132,000	43,560	175,560
(NON-CORE) REGIONAL SYSTEM	1,060,000	106,000	1,166,000	116,600	116,600	1,399,200	391,776	1,790,976
(CORE) ON-RESERVATION SYSTEM	400,000	40,000	440,000	44,000	44,000	528,000	174,240	702,240
SUBTOTAL	**1,560,000**	**156,000**	**1,716,000**	**171,600**	**171,600**	**2,059,200**	**609,576**	**2,668,776**
POWER DELIVERY FACILITIES/LINES								
CORE POWER LINES	114,500	11,450	125,950	12,595	12,595	138,545	45,720	184,265
(NON-CORE) REGIONAL SYSTEM POWER LINES	812,673	81,267	893,940	89,394	89,394	983,334	275,334	1,258,668
(CORE) RESERVATION POWER LINES	57,250	5,725	62,975	6,298	6,298	69,273	22,860	92,132
SUBTOTAL	**984,423**	**98,442**	**1,082,865**	**108,287**	**108,287**	**1,191,152**	**343,913**	**1,535,065**
MAINTENANCE EQUIP. (CTS ESTIMATES)								
TOOLS	20,000		20,000			20,000	6,600	26,600
BENCHES & EQUIPMENT	5,000		5,000			5,000	1,650	6,650
COMPUTER EQUIPMENT	5,000		5,000			5,000	1,650	6,650
METER READING EQUIPMENT	500		500			500	165	665
OFFICE EQUIP. & FURN.	2,000		2,000			2,000	660	2,660
[2] PICKUPS	180,000		180,000			180,000	59,400	239,400
SERVICE TRUCK	35,000		35,000			35,000	11,550	46,550
TRACK BACKHOE 1 1/4 CY 148 HP	184,000		184,000			184,000	60,720	244,720
LOADER/BACKHOE 1 1/4 CY	75,000		75,000			75,000	24,750	99,750
DUMP TRUCK INTERNATIONAL 3AX, 240 HP	134,500		134,500			134,500	44,385	178,885
SEMI TRACTOR	128,000		128,000			128,000	42,240	170,240
LOWBOY TRAILER, 40 T, 3AX, DROP NECK	36,000		36,000			36,000	11,880	47,880
PORTABLE TRASH PUMPS	5,000		5,000			5,000	1,650	6,650
FARM TRACTOR JD2555, 72 HP & ACCESS.	30,000		30,000			30,000	9,900	39,900
SUBTOTAL	**840,000**	-	**840,000**	-	-	**840,000**	**277,200**	**1,117,200**
TOTAL	127,027,778	12,428,695	139,456,473	13,670,464	13,670,464	166,689,115	51,315,893	218,005,008

[1] PROJECT COSTS INCLUDE 10% UNLISTED ITEMS, 10% MOBILIZATION, DEMOBILIZATION, TAXES, BONDS & INSURANCE, 10% CONTINGENCY, 32% NON-CONTRACT COSTS(CORE)
27% NON-CONTRACT COSTS(NON-CORE)

[2] 6 PICKUPS FOR REGIONAL SYSTEM (MNGR, WTP SUPR, WTP O&M PERSON, METER READER, 2 TRANS/DISTR. MAINT.)

[3] RESERVATION TRANSMISSION SYSTEM REFERED TO AS RESERVATION DISTRIBUTION SYSTEM IN EARLIER REPORTS

[4] THE COSTS FOR THE HIGH SERVICE PUMP STATION (RG#1) IS INCLUDED IN THE WATER TREATMENT PLANT COSTS

[5] THE COSTS FOR THE CORE SYSTEM STORAGE IS INCLUDED IN THE WATER TREATMENT PLANT COSTS

TABLE 8-1 REGIONAL WATER SYSTEM PROJECT COST SUMMARY

INTEREST % 5.63
INFLATION % 3.00
YEARS 50

INDIAN(CORE) COMPONENTS NON-CONTRACT PERCENTAGE= 33%
NON-INDIAN COMPONENTS NON-CONTRACT PERCENTAGE= 28%

	MAJOR FIELD ITEM COST $	UNLISTED ITEMS 10 %	SUBTOTAL	MOB /DEMOB TAXES, BONDS, & INS 10 %	CONTIN-GENCY 10 %	TOTAL FIELD COST $	NON-CONTRACT (% VARIABLE) $	TOTAL [1] PROJECT COST $
[illegible]								
Station	4,426,000	443,000	4,869,000	487,000	487,000	5,843,000	1,928,190	7,771,190
[illegible]	4,429,000	443,000	4,872,000	487,000	487,000	5,846,000	1,929,180	7,775,180
[illegible]	4,806,000	481,000	5,287,000	529,000	529,000	6,345,000	2,093,850	8,438,850
[illegible]	390,000	539,000	5,929,000	593,000	593,000	7,115,000	2,347,950	9,462,950
[illegible]	[illegible]	195,000	2,144,000	214,000	214,000	2,572,000	848,760	3,420,760
[illegible]	[illegible]	431,000	4,745,000	475,000	475,000	5,695,000	1,879,350	7,574,350
[illegible]	[illegible]	386,000	4,244,000	424,000	424,000	5,092,000	1,680,360	6,772,360
[illegible]	[illegible]	[illegible]	1,230,000	123,000	123,000	1,476,000	487,080	1,963,080
[illegible]	[illegible]	[illegible]	1,801,000	180,000	180,000	2,161,000	713,130	2,874,130
[illegible]	[illegible]	[illegible]	1,510,000	151,000	151,000	1,812,000	597,960	2,409,960
[illegible]	[illegible]	[illegible]	[illegible]	**3,663,000**	**3,663,000**	**43,957,000**	**14,505,810**	**58,462,810**
PIPELINES								
CORE PIPEL[illegible]	[illegible]	[illegible]	[illegible]	1,848,587	1,848,587	22,183,047	7,320,406	29,503,453
(NON-CORE) REGI[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4,252,097	51,025,161	14,287,045	65,312,206
(CORE) RESERVATIO[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	759,021	9,108,258	3,005,725	12,113,983
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**6,859,706**	**82,316,466**	**24,613,176**	**106,929,642**
PIPELINES CATHODIC PROTECTION								
CORE PIPE[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	624,483	206,079	830,563
(NON-CORE) REGIONAL SYSTEM PIPELINES	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,257,002	351,961	1,608,963
(CORE) RESERVATION TRANSMISSION PIPELINES	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	168,473	55,596	224,069
SUBTOTAL	**[illegible]**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**613,636**	**2,663,594**
CROSSINGS/LAND AQUISITION								
CORE PIPELINE CROSSINGS	158,124	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	68,879	277,602
CORE PIPELINE R.O W. AQUISITION	247,704	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	329,446
(NON-CORE) REGIONAL SYSTEM CROSSINGS	4,796,291	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	184,265
(NON-CORE) REGIONAL SYSTEM POWER LINES	812,673	81,267	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,258,668
(CORE) RESERVATION POWER LINES	57,250	5,725	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2,132
SUBTOTAL	**984,423**	**98,442**	**1,082,865**	[illegible]	[illegible]	[illegible]	[illegible]	**[illegible]**
MAINTENANCE EQUIP. (CTS ESTIMATES)								
TOOLS	20,000		20,000	[illegible]	[illegible]	[illegible]	[illegible]	26,600
BENCHES & EQUIPMENT	5,000		5,000	[illegible]	[illegible]	[illegible]	[illegible]	6,650
COMPUTER EQUIPMENT	5,000		5,000		[illegible]	[illegible]	[illegible]	6,650
METER READING EQUIPMENT	500		500		[illegible]	[illegible]	[illegible]	665
OFFICE EQUIP. & FURN	2,000		2,000		[illegible]	[illegible]	[illegible]	2,660
[2] PICKUPS	180,000		180,000			[illegible]	[illegible]	239,400
SERVICE TRUCK	35,000		35,000			[illegible]	[illegible]	46,550
TRACK BACKHOE 1 1/4 CY 148 HP	184,000		184,000			[illegible]	[illegible]	244,720
LOADER/BACKHOE 1 1/4 CY	75,000		75,000			75,000	24,750	99,750
DUMP TRUCK INTERNATIONAL. 3AX, 240 HP	134,500		134,500			134,500	44,385	178,885
SEMI TRACTOR	128,000		128,000			128,000	42,240	170,240
LOWBOY TRAILER, 40 T, 3AX, DROP NECK	36,000		36,000			36,000	11,880	47,880
PORTABLE TRASH PUMPS	5,000		5,000			5,000	1,650	6,650
FARM TRACTOR JD2555, 72 HP & ACCESS	30,000		30,000			30,000	9,900	39,900
SUBTOTAL	**840,000**	-	**840,000**	-	-	**840,000**	**277,200**	**1,117,200**
TOTAL	127,027,778	12,428,695	139,456,473	13,670,464	13,670,464	166,689,115	51,315,893	218,005,008

[1] PROJECT COSTS INCLUDE 10% UNLISTED ITEMS. 10% MOBILIZATION, DEMOBILIZATION. TAXES, BONDS, & INSURANCE, 10% CONTINGENCY, 32% NON-CONTRACT COSTS(CORE), 27% NON-CONTRACT COSTS(NON-CORE)

[2] 6 PICKUPS FOR REGIONAL SYSTEM (MNGR, WTP SUPR, WTP O&M PERSON, METER READER, 2 TRANS/DISTR MAINT.)

[3] RESERVATION TRANSMISSION SYSTEM REFERED TO AS RESERVATION DISTRIBUTION SYSTEM IN EARLIER REPORTS

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[5] THE COSTS FOR THE CORE SYSTEM STORAGE IS INCLUDED IN THE WATER TREATMENT PLANT COSTS

- **Total Field Cost** – the sum of field costs including contingencies and intended to represent the full amount of the budget for construction of all project facilities. In the definition presented here, easement costs are also included although a cost *in support* of construction rather than an *actual* construction cost.

- **Non-Contract Costs** – Non-contract costs are part of the project costs not related to the construction contracts or construction budgeting. Non-contract costs are shown in Table 8-2 and include preparation of plans and specifications by a design engineer (design); geotechnical and other investigations in support of design (investigations); the mitigation of environmental impacts to comply with commitments made by the sponsors pursuant to the National Environmental Policy Act (NEPA) (environmental): National Historic Preservation Act (NHPA); administration and field inspection of construction to ensure conformance with plans and specifications (construction administration); administration of the engineering and construction contracts, training, and TERO fees by the Tribe (contract administration/training/TERO); and Reclamation oversight (contract administration/Reclamation oversight).

- **Total Project Costs** – Total project costs are the sum of the field and non-contract costs and constitute the total budget for all project activities through the construction phase of the project to be funded by federal, state and local sources. Project costs do not include post-construction activities of operation, maintenance and replacement. All project costs were indexed to 2002 prices to correspond to the federal authorization amounts included in the legislation.

8.2 MAJOR CONTRACT ITEMS

The construction costs for the intake and water treatment plant is developed in Chapter 6. These costs are summarized in Table 8-1. The construction costs for the transmission pipelines; cathodic protection, and crossings/land acquisition, appurtenances are developed in Chapter 7 and are also summarized in Table 8-1.

The major contract items that are general in nature and have not been discussed include the telemetry system, power delivery facilities, and the maintenance equipment and facilities. These general items are discussed below.

TABLE 8-2
NON-CONTRACT COSTS

DESCRIPTION	INTAKE, TREATMENT PLANT AND PIPELINE TO RESERVATION	PIPE TO NON-RESERVATION WATER SYSTEMS	RESERVATION TRANMISSION SYSTEM
Design	6%	6%	6%
Investigation/ Environmental	8%	8%	8%
Construction Administration	10%	10%	10%
Contract Administration/ Training/TERO	5%	0%	5%
Contract Administration/ Reclamation Oversight(1)	4%	4%	4%
TOTAL	33%	28%	33%

Notes: (1) 4% has been negotiated with Authority/Tribe.

8.2.1 Supervisory Control and Data Acquisition (SCADA) Instrumentation

The purpose of a SCADA system is to provide communication links throughout the project and to monitor and coordinate the operation of pump stations and storage tanks. Operations at the treatment plant can also be monitored and coordinated with pumping stations and storage tanks. Information is available from the system on a real-time basis or nearly so. SCADA systems can be monitored and controlled by personal computers at one or more locations throughout the project. It is not necessary that hardware at each pumping station and storage tank is supplied by a single manufacturer. It is only necessary that a common software is used to permit coordination. The SCADA system will have its fundamental operations headquarters at the water treatment plant.

Several alternatives are available for SCADA system, including dedication of telephone lines from pumping station to pumping station, radio telemetry between pumping stations and satellite communications. Without undertaking an exhaustive investigation, satellite communications are generally regarded as too expensive, although technology may improve the cost-effectiveness of the system in the future. Telephone lines are generally considered reliable and do not involve substantial additional investment but are generally regarded as more costly in operation and maintenance than radio telemetry. Radio telemetry was chosen for the purpose of cost estimation as the method of SCADA communication. SCADA costs were estimated at $12,000 dollars per loop between pumping stations, storage tanks or other points of communication. This cost was applied to the pumping stations in the project.

Line of sight is required for radio transmission between remote terminal units. Each remote site would be used to relay or leapfrog information to a central unit at the treatment plant. Later investigations will more specifically define workable locations on higher ground for remote terminal units that can collect line of sight information from multiple units.

8.2.2 Electrical Distribution

An important benefit of locating the intake, water treatment plant and high service pumping station near Tiber Dam is that the Western Area Power Administration has major power lines and capacity at that location. Therefore, electrical distribution for the major user of power for the project will not be difficult to provide.

Single phase power will be adequate for all pump stations in the 10 to 15 horsepower range. Single phase power where workable will create additional operation and maintenance requirements to ensure that current is maintained in balance. Qualified electrical staff will be required by the project to ensure that an imbalance does not occur. Shorter lives of motors will result from periodic or sustained low-level imbalances, and equipment burnout can result from short-term imbalances of unacceptable proportions.

Revenue meters will be installed at all power delivery points. WAPA personnel indicate the installed cost of these meters should be less than $5,000 per meter.

8.2.3 Maintenance Equipment

Since the water treatment plant is centrally located, a single maintenance facility is planned for the entire transmission system at this location. The description, proposed location, and size of this facility is discussed in Chapter 6. The cost of this facility is included as a line item in this Chapter.

In addition to the maintenance facility itself, a significant amount of maintenance equipment will be required including the following:

- Miscellaneous tools
- Benches and equipment
- Computer equipment

- Meter reading equipment
- Office equipment and furniture
- Pickup trucks (6)
- Service truck
- Track backhoe
- Pump truck
- Loader/Backhoe
- Crawler tractor with dozer blade
- Semi tractor
- Lowboy trailer
- Portable track pumps
- Farm tractor
- Mowers and sprayers to maintain right-of-ways and water treatment plant site.
- Operation and maintenance staff will need to locate and make arrangements to quickly rent additional equipment such as an excavator, additional tractors, additional pumps, etc.

8.3 NON-CONTRACT COSTS

Non-contract costs are costs incurred by the sponsors for all activities surrounding, but not including, the construction of the project. These activities include engineering design, field surveys and geotechnical investigations in support of design, environmental mitigation (including, among other things, reclamation of wetlands, stream crossings and re-seeding construction corridors), federal oversight, sponsor administration, technical investigations required during construction and construction inspection. The costs presented in this section reflect growing federal and sponsor experience in similar projects and some reduction in non-contract costs based on the benefit of past experience.

8.3.1 Design

Design will be performed by a consulting engineer, subject to each sponsor input, review and approval, and will involve the preparation of plans, specifications, bidding documents and construction contract agreements. Costs were estimated at 6% for this activity.

8.3.2 Design Surveys and Geotechnical

Prior to final design and preparation of plans and specifications, detailed field surveys of proposed pipeline routes for the larger pipelines and detailed soil studies of foundation conditions for pumping stations and storage tanks will be required. Field surveys will be required for all pipeline projects to ensure that the plans and specifications reflect the proper grade for pipeline construction. Soil studies will be undertaken to determine their corrosiveness and to design cathodic protection systems. Floodplain assessment, special wetland assessment and other types of surveys in support of design may be required.

8.3.3 Environmental

There were no specific requirements for environmental mitigation identified at the time of this report. The intake in Tiber Reservoir will be designed in such a manner that the smallest of fish will not be affected by its operation. The cost of screens for this purpose is already reflected in the intake costs. It is expected that some wetlands may be crossed by the pipelines. Trees and shrubs that are removed in stream and coulee bottoms will be replaced on a 2:1 basis. Crop damages will be paid, and pipeline routes will be re-seeded to natural grasslands where crop lands are not present.

8.3.4 Construction Administration

Each project segment will have full time inspection to ensure compliance with the contractual plans and specifications developed by the engineer. This is one of the most fundamental elements of the project and is intended to ensure that the constructed quality of the project meets the contractual requirements specified by the sponsors in the agreement with the construction. Costs of this project activity are estimated at 10% of the cost of construction.

8.3.5 Construction / Training / TERO

Easement acquisition is on of the most intensive activities in the project. Many of the trust lands on the Rocky Boy's Indian Reservation will have multiple owners, including some tracts with more than 100 heirs. The process will involve certified mail contact of each heir to a particular allotment and the receipt of written permission for easement by a minimum of 50 percent of those contacted. Easement plats will be prepared before and after construction, and payment will be made to each of the heirs on the basis of the fair market value of the permanent easement.

One staff member was estimated as the requirement for a construction contract administrator within both the Rocky Boy's and North Central areas. This individual would be responsible for developing vouchers for pay requests by contractors, maintaining construction contract files containing the original agreement and any subsequent change orders, monitoring project construction schedules for compliance, ensuring environmental compliance and maintaining records of contractor employment and wages.

Both parts of the project would employ a project accounting staff that would be responsible for

for this activity. An initial coding system would be established for each contract and non-contract expenditure and for records of time and activity by all non-contract staff. A system for acquisition of all purchased items by purchase order, voucher or comparable accounting tool would be developed and implemented. The system would be reviewed periodically by the professional accounting staff described further.

In addition to the project accounting staff, professional accounting services should be provided annually in the cost estimate for sponsor administration to perform an annual review and audit to comply with Section 913(f)(6) of the Authorizing Legislation. Moreover, legal services should be provided annually in the cost estimate. Legal expertise would be required for review of cooperative agreements and modifications between the sponsors and the Bureau of Reclamation, for review of construction and consulting contracts, and to represent the sponsor in any claim made against the project. Legal expertise may also be required for wheeling agreements with the local rural electric cooperatives and for other purposes.

Sponsor coordination and training were also provided in the cost estimate for non-contract activities. It was estimated that 2.5 individuals would be required on the Rocky Boy's Indian Reservation to manage the tribal staff. The staff would include a project director, an assistant and a secretary, the latter sharing duties with the easement and contract administration staff. It was estimated that two individuals would be required for North Central for the same functions.

Each sponsor will have costs for advisory or steering committee members that are representatives of the project from outside the project staff. It was estimated that these individuals would receive $100 per meeting and would be available for 12 meetings per year. A total of 6 advisory or steering committee members for each sponsor was included in the cost estimate. In addition to staff and committee members, each sponsor will incur non-labor costs for travel and maintenance of office equipment and space.

8.3.6 Construction Administration / Reclamation

The Bureau of Reclamation will oversee the expenditure of federal funds in construction of the project. The functions of the Bureau of Reclamation will be to review initial planning documents for the purpose of providing guidance, direction and requirements of the United States for project implementation. Reclamation will also review and approve final plans and specifications for construction of the project at the 35 and 95 percent complete stages and will provide guidance and direction on construction agreements resulting from a bidding or force account process. Value Engineering will be performed on selected design projects, typically at the 35 percent complete stage. Reclamation will take all necessary steps to ensure compliance with federal environmental requirements, NHPA, and other Federal requirements. Reclamation will develop and monitor cooperative agreements with the sponsors for the planning, design and construction of expenditures and the ability to complete the project within the congressionally authorized ceiling.

8.4 SOURCE OF FUNDS

The authorizing legislation (PL 107-331) includes the cost distribution authorized for appropriations for this project. Table 8-3 shows the authorized cost distributions from the legislation.

PL 107-331 states the following relative to the federal appropriations for the core system.

> *SEC. 914. AUTHORIZATION OF APPROPRIATIONS.*
>
> *(a) Core System.—There is authorized to be appropriated $129,280,000 to the Bureau of Reclamation for the planning, design, and construction of the core system. The Tribal portion of the costs shall be 76 percent. The Authority's portion of the costs shall be 24 percent.*
>
> *SEC. 904. ROCKY BOY'S RURAL WATER SYSTEM.*
>
> *(b) Core System.—*
> *(1) In General.—The Secretary is authorized to plan, design, construct, operate, maintain, and replace the core system.*
> *(2) Federal Share.—*
> *(A) The Federal share of the cost of planning, design, and construction of the core system shall be—*
> *(i) 100 percent of the Tribal share of costs as identified in section 914;*
> *(ii) 80 percent of the authority's share of the total cost for the core system as identified in section 914; and*
> *(iii) funded through annual appropriations to the Bureau of Reclamation.*

TABLE 8-3
PL 107-331 ACT OF 2002 AND JUNE 2004 FER PROJECT COSTS

	Total		Federal			State & Local	
	Authorization	FER	Authorization	Notes	FER	Authorization	FER
Core (Tribe)	$ 98,400,000	$ 88,705,248	$ 98,400,000	100% of 98.4m, 76% of 129.28m	$ 88,705,248	n/a	n/a
Core (Authority)	$ 38,600,000	$ 34,796,977	$ 30,880,000	80% of 38.6m, 24% of 129.28m	$ 27,837,582	$ 7,720,000	$ 6,959,396
Core (Total)	$137,000,000	$ 123,502,225	$ 129,280,000	94.36% of 137m	$ 116,542,830	$ 7,720,000	$ 6,959,396
Non-Core	$ 92,000,000	$ 94,502,783	$ 73,600,000	80% of 92.0m	$ 75,602,226	$ 18,400,000	$ 18,900,556
Total	$229,000,000	$ 218,005,008	$ 202,880,000		$ 192,145,056	$ 26,120,000	$ 25,859,952

PL 107-331 states that the Tribal portion of the costs authorized for appropriation for the planning, design, and construction of the core system are 76% of $129,280,000 or $98,400,000. The Authority's portion of the costs are 24% of $129,280,000 or $30,880,000. The $30,880,000 must be matched with state and local funding in a ratio of 80%/20% (Sec. 904 of PL 107-331), which results in state and local funding of $7,720,000.

The percentages listed in Sec. 904 and 914 were specified so that if the cost of the project changed in the FER, the proportionate share of the project paid from each source would remain the same. To demonstrate how allocation of costs would be applied to a new FER estimate, the following percentages listed below can be used.

Authorized Core System Costs:

Tribe (Federal)	$ 98,400,000
Authority (Federal)	$ 30,880,000
Federal	$129,280,000
State and Local	$ 7,720,000
Total	$137,000,000

Using these numbers, the following percentages can be calculated:

Tribe (Federal) $98,400,000/$137,000,000	71.82%
Authority (Federal) $30,880,000/$137,000,000	22.54%
Authority (State/Local) $7,720,000/$137,000,000	5.64%
	100.00%

Using these percentages, FER costs can be distributed:

Core System:	
Tribe (Federal) .7182 ($123,502,225)	$88,699,298
Authority (Federal) .2254 ($123,502,225)	$27,837,402
Authority (State/Local) .0564 ($123,502,225)	$ 6,965,525
Total FER	$123,502,225

As shown in Sec. 904 and Table 8-3, non-core costs are split 80% federal and 20% state and local in the "project cost" and "FER" cost estimates.

Table 8-3 shows that the non-core federal share exceeds the authorized ceiling of $73,600,000 by about $2,000,000. The reason for this increase in the non-core system cost was the addition of Cut Bank as one of the communities served. Therefore, this additional cost will need to be funded through other local or state sources rather than by the federal government unless there are sufficient cost savings during the actual construction process to allow the addition of Cut Bank without exceeding the federal authorization.

The Tribe will use $10,000,000 of the $15,000,000 in their water rights settlement for improvements to the on-reservation distribution system. These improvements are separate from those shown in this FER. The remaining $5,000,000 will be added to the tribal O&M trust fund along with $15,000,000 from the federal government.

9. CONSTRUCTION SCHEDULE

The authorizing legislation does not provide a time frame for completion of this project. Therefore, as with other similar MR&I projects, approximately 10 years would be required to complete the construction of the entire system. Major facilities such as the reservoir intake and water treatment plant would be completed first to allow service as soon as possible when pipeline segments are completed.

The Congressional budget for FY 2004 includes a modest appropriation for this project and was intended to allow completion of several components prior to construction. Items requiring completion in FY 2004 include the environmental assessment, Reclamation's review of the Final Engineering Report, and other investigations necessary to start design of the project. These other investigations will include conducting a pilot test for the water treatment plant and geotechnical investigations for final selection of the intake alternative.

Table 9-1 shows the proposed expenditures for the sequence of construction developed for a generic 10-year construction period. All references to time frame will be to this 10-year construction period. The schedule was developed to allow constructing the segments in a logical and efficient manner. Major components were shown as being constructed in up to two fiscal years, especially since the construction duration for the treatment plant, the core pipeline to the Rocky Boy's Reservation, and the major transmission pipeline west of the treatment plant to Shelby will all be longer than one year.

This proposed schedule should be considered as an initial proposal for funding in each fiscal year. The actual activities in advance of construction will need to be modified based on each fiscal year's appropriation. This sequencing plan is envisioned to be dynamic and subject to change. This table breaks down the construction field costs and non-contract costs for the core system and the non-core system as well as funding sources. Also shown on this table are the anticipated sources of funding including the federal government, State of Montana Share, and the local share for the Authority.

TABLE 9-1

PROJECT CASHFLOW PROJECTION (Staged)

Segment	Total Cost		Year										
CORE			1	2	3	4	5	8	7	8	9	10	Total
Intake	$7,771,190	Contract	$5,206,697										$5,206,
		Non-Contract	$2,564,493										$2,564,
Water Treatment Plant Phase I	$43,109,290	Contract		$14,441,612	$14,441,612								$28,883,
		Non-Contract	$3,556,516	$7,113,033	$3,556,516								$14,226,
Water Treatment Plant Phase II	$665,000	Contract					$445,550						$445,5
		Non-Contract				$109,725	$109,725						$219,4
Water Treatment Plant Phase III	$8,034,530	Contract							$5,383,135				$5,383,1
		Non-Contract						$1,325,697	$1,325,697				$2,651,3
Core Pipeline - WTP to Rocky Boy's	$32,264,786	Contract				$7,205,802	$7,205,802	$7,205,802					$21,617,4
		Non-Contract			$2,661,845	$2.661,845	$2,661,845	$2,661,845					$10,647,3
Core (On-Reservation System)	$31,657,429	Contract				$7,070,159	$7,070,159	$7,070,159					$21,210,4
		Non-Contract			$2,611,738	$2,811,738	$2,611,738	$2,811,738					$10,446,9
Federal (Tribal)	**$88,705,248**		**$8,809,057**	**$18,381,530**	**$17,888,501**	**$14,941,044**	**$15,279,862**	**$14,799,923**	**$1,007,530**	**$0**	**$0**	**$0**	**$88,705,2**
Federal (Authority)	**$27,837,582**		**$2,718,850**	**$5,173,115**	**$5,585,211**	**$4,718,225**	**$4,825,157**	**$4,499,058**	**$318,187**	**$0**	**$0**	**$0**	**$27,837,5**
State (Authority)	**$3,479,698**		**$0**	**$0**	**$0**	**$0**	**$0**	**$788,130**	**$2,891,588**	**$0**	**$0**	**$0**	**$3,479,8**
Local (Authority)	**$3,479,698**		**$0**	**$0**	**$0**	**$0**	**$0**	**$788,130**	**$2,691,588**	**$0**	**$0**	**$0**	**$3,479,8**
Subtotal	**$123,502,225**		**$11,327,708**	**$21,554,845**	**$23,271,711**	**$19,859,269**	**$20,104,819**	**$20,875,241**	**$8,708,833**	**$0**	**$0**	**$0**	**$123,502,2**
Total Cummulative			**$11,327,708**	**$32,882,351**	**$58,154,083**	**$75,813,332**	**$95,918,151**	**$118,793,392**	**$123,502,225**	**$123,502,225**	**$123,502,225**	**$123,502,225**	
NON-CORE													
Pipeline Core to Tiber County	$2,397,940	Contract					$1,726,516						$1,726,5
		Non-Contract				$335,712	$335.712						$671,42
Pipeline Core to Riverview Colony	$760.112	Contract							$547,280				$547,28
		Non-Contract						$108,416	$108.416				$212,83
Pipeline Core to Loma	$2,551,525	Contract						$1,837,098					$1,837,09
		Non-Contract					$357,214	$357,214					$714,42
Pipeline Core to Hill County	$601.498	Contract				$433,078							$433,07
		Non-Contract			$84,210	$84,210							$168,41
Pipeline Core to North Havre	$3,899,537	Contract							$2,807,667				$2,807,66
		Non-Contract						$545,935	$545.935				$1,091.87
Pipeline Core to Big Sandy	$1,372,845	Contract							$988,449				$988,44
		Non-Contract						$192,198	$192,198				$384,39
Pipeline Core to Shelby	$36,270,297	Contract							$13.207,307	$12,907,307			$26,114,61
		Non-Contract	$150,000	$150,000				$2.538,921	$4,777,842	$2,538,921			$10,155,68
Pipeline Core to Chester	$5,391,537	Contract				$3,881,907							$3,881,90
		Non-Contract			$754,815	$754,815							$1,509,83
Pipeline Chester to Galata/Eagle Creek Colo	$4,097,487	Contract									$2,950,191		$2,950,19
		Non-Contract								$573,648	$573.648		$1,147.29
Pipeline Galata to Sage Creek	$3,090,124	Contract										$2,224,890	$2,224,89
		Non-Contract									$432,617	$432,617	$865.23
Pipeline Non-Core to Devon	$307,850	Contract								$221,652			$221,65
		Non-Contract							$43,099	$43,099			$86,19
Pipeline Shelby to Conrad	$19,435,908	Contract									$13,993,854		$13,993,85
		Non-Contract								$2,721,027	$2,721,027		$5,442,05
Pipeline Conrad to Dutton	$2,271,435	Contract										$1,835,433	$1,835,43
		Non-Contract									$318,001	$318,001	$636,00
Pipeline Shelby to Oilmont	$3,129,317	Contract										$2,253,108	$2,253,10
		Non-Contract									$438,104	$438.104	$876.20
Pipeline Oilmont to Sweetgrass	$2,241,887	Contract										$1,614,159	$1,814,15
		Non-Contract									$313,864	$313,864	$627,72
Pipeline Shelby to Cut Bank	$6,683,483	Contract										$4,812,108	$4,812,10
		Non-Contract									$935,688	$935.688	$1,871,37
Federal (Authority)	**$75,802,228**		**$150,000**	**$150,000**	**$0**	**$0**	**$0**	**$4,875,891**	**$23,218,193**	**$19,005,854**	**$22,878,994**	**$5,527,893**	**$75,802,22**
State (Authority)	**$9,450,278**		**$0**	**$0**	**$839,025**	**$5,489,722**	**$2,419,442**	**$702,090**	**$0**	**$0**	**$0**	**$0**	**$9,450,27**
Local (Authority)	**$9,450,278**		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$9,450,278**	**$9,450,27**
Subtotal	**$94,502,783**		**$150,000**	**$150,000**	**$839,025**	**$5,489,722**	**$2,419,442**	**$5,577,782**	**$23,218,193**	**$19,005,654**	**$22,878,994**	**$14,977,972**	**$94,502,78**
TOTAL CORE and NON-CORE													
Federal (Tribal)	**$87,361,994**		**$8,609,057**	**$18,381,530**	**$17,888,601**	**$14,941,044**	**$16,279,882**	**$14,799,923**	**$1,007,530**	**$0**	**$0**	**$0**	**$88,705,24**
Federal (Authority)	**$98,573.588**		**$2,888,650**	**$5,323,115**	**$5,585,211**	**$4,718,225**	**$4,826,157**	**$9,374,760**	**$23,534,360**	**$19,005,854**	**$22,878,994**	**$5,527,893**	**$103,439,80**
Federal Total	**$192,145,058**		**$11,477,708**	**$21,704,845**	**$23,271,711**	**$19,859,289**	**$20,104,819**	**$24,174,673**	**$24,541,890**	**$19,005,854**	**$22,876,994**	**$5,527,893**	**$192,145,05**
State (Authority)	**$12,929,978**		**$0**	**$0**	**$839,025**	**$5,489,722**	**$2,419,442**	**$1,490,220**	**$2,891,588**	**$0**	**$0**	**$0**	**$12,929,97**
Local (Authority)	**$12,929,976**		**$0**	**$0**	**$0**	**$0**	**$0**	**$788,130**	**$2,891,588**	**$0**	**$0**	**$9,450,278**	**$12,929,97**
TOTAL	**$218,005,008**		**$11,477,706**	**$21,704,645**	**$24,110,736**	**$25,148,991**	**$22,524,261**	**$26,453,023**	**$29,925,025**	**$19,005,654**	**$22,676,994**	**$14,977,972**	**$218,005,008**

Notes 1) All costs shown in this table are in October 2002 dollars and have not been adjusted for indexing.
2) The allocation of funding between Tribal and non-tribal projects will be negotiated at a later date.
3) Non-contract costs for Tribal share of the project will be 33%
3) Non-contract costs for non-Tribal share of the project will be 28%

9.1 CONSTRUCTION BY PROJECT SEGMENT

The intake, water treatment plant, and the core pipeline to the Rocky Boy's Reservation will be the first priorities. Therefore, the proposed construction schedule shows the intake being constructed in the first year of construction (Year 1) and the water treatment plant being constructed in the next two years (Years 2 and 3). Once complete, the system will be able to start delivering water in Year 4.

The next major component to be constructed will be the Core pipeline to the Reservation. This segment is large enough to also be constructed in three fiscal years (Years 4, 5, and 6). The first entity to hook up to the system may be the Hill County Water District. Even though the main feed for this district will be as shown on Figure 7-4 on the east edge of the system, this district has a summer source of supply that crosses the alignment of the core pipeline directly south of Inverness. This connection will only be able to serve approximately half of the Hill County Water District (west of Hingham). The Hill County Water District has some of the most pressing water quality issues as indicated by the Montana DEQ and should be served as soon as funding will allow. Connections to the core pipeline to non-tribal communities will be made utilizing state funding as available.

As the core pipeline to the Reservation is completed, the on-reservation system (Rocky Boy's Rural Water System) is also scheduled for completion in years 4, 5, and 6. The segments to the other communities served from the core pipeline to the east will be completed in years 4 through 7. These communities include the following:

- Tiber County Water District
- Riverview Colony
- South Chester County Water District
- Loma County Sewer and Water District
- Hill County Water District
- North Havre County Water District
- Town of Big Sandy

As stated above, some of these segments to these communities and water districts will be constructed as the core pipeline is constructed to the east using state funding. Therefore, the actual order in which these entities will be connected to the regional system may not be known until a year or two prior to connection. The timing of these connections will depend largely upon the appropriations made by the State of Montana.

Once the pipeline is completed to the east, the west segment can be completed. The communities and water districts served will be systematically completed starting at the water treatment plant and proceeding west. The major segment of this pipeline is the segment from the water treatment plant to the City of Shelby. Again, this segment is large enough that it will probably take two fiscal years to complete both from a construction and an appropriation standpoint.

Once the main west branch of the non-core pipeline has been constructed, the segments to the other communities, colonies, and water districts can be completed. These entities include the following:

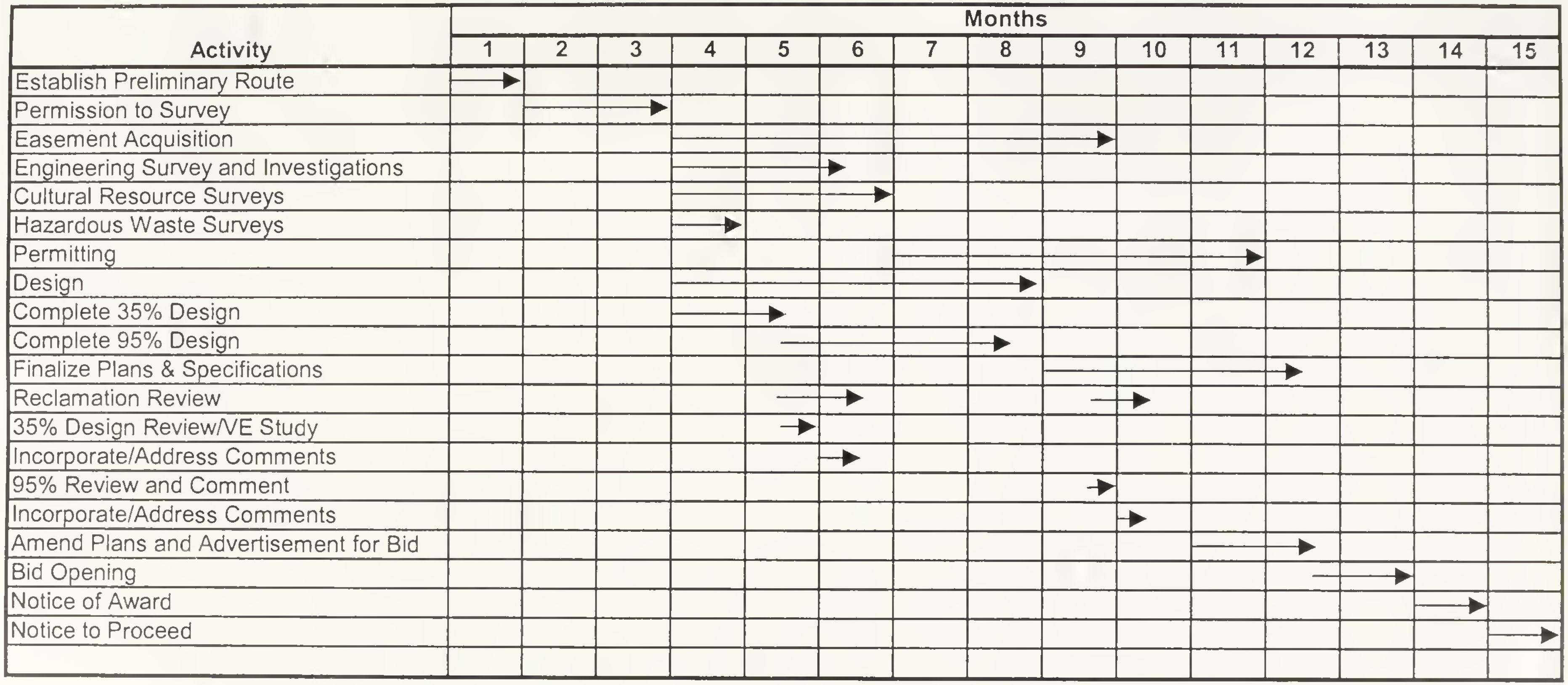
- Town of Chester
- Galata County Water district
- Eagle Creek Colony
- Sage Creek County Water District
- Sage Creek Colony
- Devon Water Incorporated
- City of Conrad
- Town of Dutton
- Oilmont County Water District
- Town of Sunburst
- Sweetgrass Community Water and Sewer District

As with the core pipeline to the east, some of these segments to these communities and water districts may be able to be constructed as the western pipeline is constructed depending on funding. Therefore, the actual order in which these entities will be connected to the regional system may not be known until a year or two prior to connection. The timing of these connections will depend largely upon the appropriations made by Congress and the State of Montana.

9.2 ACTIVITIES IN ADVANCE OF EACH YEAR'S CONSTRUCTION

Table 9-2 provides a hypothetical schedule of activities in advance of the start of construction on the annual work plan for a pipeline segment or combination of segments. The schedule is intended to list typical activities, including those along the critical path and those that have more latitude for starting and ending times. In general the activities are listed in order of progression. The schedule provides for 15 months for design level activities starting in February of the first-year and ending on or about May 1 of the following year. May 1 is intended to represent a typical start to the construction season. Clearly, in some years the construction season could begin earlier.

TABLE 9-2
ILLUSTRATIVE SCHEDULE OF ACTIVITIES IN ADVANCE OF CONSTRUCTION START



This illustrative schedule can be shortened on the front end of the activities, ending with the submission of plans and specifications to the Bureau of Reclamation for review. Less room for adjustment is available from the start of Reclamation review to the notice to proceed, shown as a period of six months. This schedule may be compressed to four months for some projects depending on the start date and the complexity of the project.

9.2.1 Preliminary Route

The first step in the list of activities is the establishment of a preliminary route based on field investigations by the design engineer and easement personnel. This investigation would involve an examination of construction conditions on one side of a highway or road to compare with conditions on the other side. Land ownership and potential for acquiring easements would likewise be evaluated. The design engineer and the easement staff would agree on a proposed route, and pipeline alignment and pump station and reservoir locations would be overlaid on a map of land ownership. This step could normally be completed in the field in a few weeks time followed by preparation of the necessary maps. A total of 30 days was allocated for this activity (Table 9-2).

9.2.2 Permission to Survey and Easement Acquisition: Rocky Boy's Indian Reservation

Permission to survey is the next activity to be undertaken. This step is the prerequisite to the start of (1) design surveys necessary to develop final plans and specifications, (2) cultural resource surveys, (3) hazardous-waste surveys and (4) any additional field work needed for design or environmental compliance. Programmatic Agreements for both on and off-Reservation will need to be developed as soon as possible. Due to the cost of mitigation and other factors, if a cultural resource that is eligible for listing with the National Register of Historic Places is encountered, it will be avoided if at all possible. This step is also the initial phase of easement acquisition.

Federal regulations require consent of landowners to conduct surveys on individually owned or tribal trust lands or on government owned lands within the Rocky Boy's Indian Reservation (or on any Indian Reservation). A written application must be filed with the Secretary (of Interior) specifying the length and width of the easement. The Chippewa-Cree Tribe can be granted a waiver by the Secretary on the deposit of funds for estimated damages to property, provided the Tribes agree to pay damages, if any, in a timely manner.[9] The application for easement must contain executed stipulations agreeing to construct and maintain the easement in a workman-like manner; to promptly pay all damages caused by survey, construction or operation and maintenance; to restore lands as nearly as possible to their original condition; to take protective measures to conserve soil and other resources, including week control; to build and repair driveways, roads, fences that may be damaged by construction work and to provide alternative access during construction; and to ensure that the project will not interfere with the use of lands by the landowner for any purpose not related to the primary purpose of the easement.[10]

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[9] 25 CFR 169.4, Permission to Survey.

On the Rocky Boy's Indian Reservation, maps are required as part of the application for easement. A separate map is required for each 20 miles of easement. The scale of the map should be 2,000 feet to 1 inch. The maps must show the boundaries for all allotted (individual Indian owned) lands with tract number and all tribal lands included in the easement. Sections, townships and ranges must also be provided.[11] Field notes of the survey are to be shown on the maps or on separate filings. One or more ties to public survey lines must be given for each map sheet.[12] The end of the pipeline route shall be fixed by reference to course and distance to the nearest existing corner of a public survey with an engineer's affidavit and certificate to show these connections.[13] An affidavit must be executed by the engineer who made the survey, and a certificate must be executed by the applicant. Both must certify to the accuracy of the survey and maps for each project segment to be included in a construction contract.[14]

The consideration for any easement shall not be less than the fair market value of the easement, including damages, if any. The Secretary must advise the landowners of the appraisal and assist the landowners in negotiations with project staff for easements.[15] If the original grant of easement is modified, amended maps and field notes of the new location must be filed with the consent of the landowner.[16] All easements for water treatment plants, water control facilities, public utility pipelines (including pumping stations and appurtenant facilities) may be granted for a term of years without limitation.[17]

An agreement between the project and a landowner must be executed before any work by the project to construct service lines cross allotted lands where a service line is for the purpose of supplying the landowner with water. All agreements must be executed before construction. The agreement requires an attached map showing the location, size and extent of pipeline. The executed agreement must be filed with the Secretary within 30 days of its execution.[18]

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[10] 25 CFR 169.5, Application for Right-of-Way.

[11] 25 CFR 169.6, Maps.

[12] 25 CFR 169.7, Field Notes.

[13] 25 CFR 169.8, Public Survey.

[14] 25 CFR 169.11, Affidavit and Certificate.

[15] 25 CFR 169.12, Consideration for Right-of-Way Grants.

[16] 25 CFR 169.17, Change of Location.

[17] 25 CFR 169.18, Tenure of Approved Right-of-Way Grants.

[18] 25 CFR 169.22, Service Lines.

Widths of easements for pipelines will be decided during project implementation. During construction, transmission line easement widths of 75 to 100 feet and distribution and service line easements of 50 feet will be sought. Permanent easements for the operation and maintenance of 35 to 50 feet will be sought.

Purchase of lands, rather than acquisition of easements, will be sought for above-ground facilities, such as the intake, water treatment plant (and related facilities), pumping stations, buildings and reservoirs. As a matter of project policy leases will not be considered for either pipeline easements or above-ground facilities.

The acquisition of lands and easements described in this section is a major task. The requirements of the task are made more difficult by the fact that many of the allotted (individually owned Indian) lands have multiple owners stemming from the conveyance of property from one generation to the heirs of successive generations. Allotted lands with more than 50 owners is not uncommon. Permission to survey and an easement can be granted by the Secretary with the consent of the individual Indian owners when a majority of the interests consents to the grant. For example, with the consent of 26 heirs, an easement across lands owned by 50 individuals can be granted.

Table 9-2 provides an eight-month period for the acquisition of permissions to survey and easements. As stated above, the permission to survey must be acquired prior to entry on the land to collection information to obtain easements, and easements must be acquired before the start of construction. In theory, the 15 month schedule could be shortened to nine months if the end of the easement process coincided with the start of construction. As shown, however, six months are provided between the end of the easement process and the start of construction. This schedule is intended to draw attention to the fact that final design and the easement process depend upon one another and adjustments are necessary to both for a satisfactory conclusion. Often the preliminary route selection, based on preliminary design preference and preliminary knowledge of landowners' willingness to grant easements, will require adjustment to reflect a previously unknown design problem or an unwilling landowner. If a route change is necessary, the process used for the preliminary routing must be repeated for the adjusted, final route. It is preferable if the easement process has been nearly completed by the time that the plans and specifications have been submitted by the design engineer to the Bureau of Reclamation for review. If the easement process is timed to more closely coincide with the start of construction, difficulties in obtaining easements may delay the start of construction and / or increase the cost of construction.

Private or fee lands on the Rocky Boy's Indian Reservation will be treated in the same manner as individual Indian, tribal and government lands, although the process is not required by federal regulation.

9.2.3 Permission to Survey and Easement Acquisition: North Central Montana Rural Water System Authority

The same activities of acquiring permissions to survey and easement acquisitions on private lands off-reservation are less formal and subject to less regulation than on the Rocky Boy's Indian Reservation. The Authority will establish its own formal policy for acquiring permissions to survey and acquiring easements from private landowners, subject to the requirements of the respective county clerks and Montana law governing surveys for easements. The Authority contemplates donation easements on private lands crossed by the project.

It would be possible, for example, for the Authority to specify a legal description of considerable width, say a quarter of a mile, to be agreed upon between the landowner and filed with the county, as a preliminary easement. This preliminary easement could specify a construction width of 50 to 100 feet and a permanent width of 35 to 50 feet or as agreed between the landowner and the Authority. A final easement could be filed with the county and the landowner after construction based on actual locations determined by global positioning system (GPS) methods that would accurately locate the final easement within the original, preliminary broader band.

Procedures for permission to survey and easements would be more rigorous and would more closely parallel the procedures on the Rocky Boy's Indian Reservation where lands owned by the State of Montana or federal lands are needed for project construction. The only simplification in these cases would be that of a single, rather than multiple, landowners. State lands will require rigorous environmental and cultural resource field reviews for each tract of land requiring easement. Easements on State and any federal lands in the Authority area will be acquired at fair market value or as negotiated.

In the case of both the Rocky Boy's Tribe and the Authority, the administrative staff requirements and costs presented in Chapter 8 for easement acquisition reflect the relative differences in level of effort required in the respective project areas.

9.2.4 Surveys and Investigations for Engineering, Cultural Resource and Hazardous Waste Purposes

Table 9-2 presents a period of approximately 3 months for these categories of activities. The activities require access to land ownership in the project and follow grants of permission to conduct surveys. Engineering surveys and investigations include routing of pipelines, siting of above-ground facilities, GPS and other surveys to establish precise locations, and geotechnical investigations to determine subsurface conditions for construction of foundations. These cultural resource and hazardous waste surveys will identify potential obstacles for the chosen alignments.

Pipeline routes will be adjusted based on these surveys. Permitting of the alignments will be accomplished under the permitting time line over the next 5 months.

Class III cultural resource investigations and hazardous waste surveys are field investigations needed to comply with environmental commitments in advance of construction.

9.2.5 Permitting

Permitting will be required for stream, highway and railroad crossings, among other types of permitting. This activity will require the completion of cultural resource and hazardous waste surveys as well as substantial completion of design. The project will acquire most permits, and the process will become reasonably routine as the affected agencies and project staff gain experience with the several applications for permits. A period of 90 days is included in the illustrative schedule for the processing of permits after the completion of an application for permit.

9.2.6 Design, Design Review and Plan Amendment

Design is scheduled for a five-month period, with a review of the 35 percent complete stage (VE for some projects also) and a review at the 90-95 percent complete stage followed by two months of review by the Reclamation and an additional six weeks to respond to the comments from the Reclamation review, re-submission of the plans and specifications and release of an advertisement for competitive bids. At the time of submission of plans and specifications to the Reclamation for review, the design will be 90% to 95% complete. The design engineer will respond to all Reclamation review comments. Appropriate changes will be made, and the plans and specifications will be resubmitted to the Reclamation for final approval. The plans and specifications will be submitted to the appropriate agency for review and approval prior to advertising for bids.

9.2.7 Period of Advertisement, Bid Opening, Notice of Award and Notice to Proceed

With the plans 100% complete and approved, an advertisement for bids will be made with a 30 to 45-day timeframe available for contractors to prepare their price proposals in conformity with the plans and specifications. Advertisement and bid opening documentation will be submitted to the appropriate agency for review. A pre-bid meeting will be held during the advertisement period to provide contractors with the opportunity to clarify questions they may have with regard to the plans and specifications. Following the advertisement, a bid opening will be held. This schedule would be at the end of month 13 in Table 9-2. Project staff would then evaluate bids to check the accuracy of the bid proposals and to evaluate qualifications of the apparent low bidder. A one-month timeframe is provided in the schedule, but in most cases a week or ten days would be adequate. The one-month timeframe is not unreasonable, however, because the owner may require time to schedule a meeting with individuals or boards responsible for policy decisions, such as the approval for a notice of contractor award. Project staff will submit its recommendations for award to Bureau of Reclamation.

When the successful bidder has been identified and policy decisions and approvals are complete, a notice of award will be issued that will require the successful contractor to produce documents in support of the bid, including necessary certifications and representations, literature from manufacturers and other materials. The construction contract will not be awarded until DEQ authorizes the award. Following review and approval of the submissions, construction contract agreements can be executed by both the owner and the contractor. A notice to proceed with construction can then be issued.

TABLE 10-1
DESIGN YEAR OPERATIONS, MAINTENANCE, AND REPLACEMENT COSTS

	REGIONAL SYSTEM			INDIAN ONLY SYSTEM			
	ANNUAL O&M COSTS	ANNUAL REPLACEMENT COSTS	ANNUAL OM&R COSTS	ANNUAL O&M COSTS	ANNUAL REPLACEMENT COSTS	ANNUAL OM&R COSTS	NON-INDIAN ANNUAL OM&R COSTS
INTAKE & WATER TREATMETN PLANT O&M							
INTAKE & RAW WATER PUMP STATION	$ 20,304	$ 46,834	$ 67,138	$ 11,013	$ 25.403	$ 36.416	$ 30.722
POWER	$ 64,336		$ 64,336	$ 34,896		$ 34.896	$ 29.440
PRETREATMENT	$ 17,451	$ 50,858	$ 68,309	$ 9,465	$ 27.585	$ 37,051	$ 31,258
POWER	$ 23,675		$ 23,675	$ 12,841		$ 12.841	$ 10.834
FILTER BUILDING	$ 76,460	$ 57,030	$ 133,490	$ 41,472	$ 30.933	$ 72,405	$ 61,085
POWER	$ 1,704		$ 1,704	$ 924		$ 924	$ 780
CLEARWELL	$ -	$ -	$ -	$ -	$	$ -	$ -
HIGH SERVICE PUMP STATION	$ 39,098	$ 45,648	$ 84,746	$ 21,207	$ 24.759	$ 45.966	$ 38.780
POWER	$ 109,172		$ 109,172	$ 59,215		$ 59 215	$ 49.957
CHEMICAL BUILDING	$ 425,608	$ 40,815	$ 466,423	$ 230,850	$ 22.138	$ 252,988	$ 213,435
POWER	$ 3,580		$ 3,580	$ 1,942		$ 1,942	$ 1.638
RECOVER PUMP STATION	$ 16,829	$ 11,831	$ 28,660	$ 9,128	$ 6 417	$ 15,545	$ 13,115
POWER	$ 11,418		$ 11,418	$ 6,193		$ 6,193	$ 5,225
PONOS	$ 183,332	$ -	$ 183,332	$ 99,439	$ -	$ 99.439	$ 83.893
ADMINISTRATION/MAINTENANCE BUILDING	$ 74,750	$ -	$ 74,750	$ 40,544	$	$ 40,544	$ 34.206
Power	$ 114		$ 114	$ 62		$ 62	$ 52
SUBTOTAL	$ 1,067,830	$ 253,015	$ 1,320,846	$ 579,191	$ 137,235	$ 716,427	$ 604,419
TRANSMISSION SYSTEM							
METER READERS(2080 HRS*#*$9 00*1 35 FRINGE)	$ 29,063		$ 29,063	$ -		$ -	$ 29.063
O&M PERSONNEL(2080 HRS*#*$12 75*1 35 FRINGE)	$ 123,517		$ 123,517	$ 82,345		$ 82,345	$ 41,172
EQUIPMENT RENTAL @ $500/MO	$ 6,900		$ 6,900	$ 6,900		$ 6,900	$ -
MATERIALS & SUPPLIES	$ 28,750		$ 28,750	$ 17,250		$ 17,250	$ 11,500
TRAVEL - METER READER ($50/DAY*2 DAY/MO *12 MOS)	$ 1,380		$ 1,380	$ -		$ -	$ 1,380
TRAVEL - O&M PERSONNEL ($50/OAY*2 DAY/MO *12 MOS)	$ 4,140		$ 4,140	$ 2,760		$ 2,760	$ 1,380
PIPELINES REPAIR & REPLACEMENT	$ -		$ -	$ -		$ -	$ -
CORE PIPELINE	$ 6,900	$ 39,362	$ 46,262	$ 5,750	$ 21.350	$ 27,100	$ 19,162
(NON-CORE) REGIONAL PIPELINE MAINTENANCE	$ 23,000	$ 90,351	$ 113,351	$ -		$ -	$ 113,351
(CORE) RESERVATION TRANSMISSION PIPING MAINTENANCE	$ 5,750	$ 16,179	$ 21,929	$ 5,750	$ 16,179	$ 21,929	$ -
SUBTOTAL	$ 229,400	$ 145,893	$ 375,292	$ 120,755	$ 37,529	$ 158,284	$ 217,008
PUMP STATION O&M							
NON-CORE PUMP STATION MAINT /RPLCMNT PARTS	$ 28,750	$ 66,000	$ 94,750	$ -		$ -	$ 94,750
NON-CORE TRANSMISSION PUMP STATION POWER	$ 180,329		$ 180,329	$		$ -	$ 180,329
CORE TRANSMISSION PUMP STATION MAINT /RPLCMT PARTS	$ 11,500	$ 41,734	$ 53,234	$ 11.500	$ 41,734	$ 53,234	$ -
CORE TRANSMISSION PUMP STATION POWER	$ 56,016		$ 56,016	$ 56,016		$ 56.016	$ -
SUBTOTAL	$ 276,595	$ 107,734	$ 384,330	$ 67,516	$ 41,734	$ 109,250	$ 275,079
TELEMETRY/STORAGE							
CORE SYSTEM	$ 17,710		$ 17,710	$ 17,710		$ 17,710	$ -
(NON-CORE) REGIONAL SYSTEM	$ 41,170		$ 41,170	$ -		$ -	$ 41,170
(CORE) ON-RESERVATION SYSTEM	$ 14,260		$ 14,260	$ 14,260		$ 14.260	$ -
SUBTOTAL	$ 73,140	$ -	$ 73,140	$ 31,970	$ -	$ 31,970	$ 41,170
MAINTENANCE EQUIPMENT (CTS ESTIMATES)							
TOOLS	$	$ 1,778	$ 1,778	$ -	$ 964	$ 964	$ 814
BENCHES & EQUIPMENT	$	$ 444	$ 444	$	$ 241	$ 241	$ 203
COMPUTER EQUIPMENT	$	$ 667	$ 667	$ -	$ 362	$ 362	$ 305
METER READING EQUIPMENT	$	$ 44	$ 44	$	$ 24	$ 24	$ 20
OFFICE EQUIP & FURN	$	$ 64	$ 64	$	$ 35	$ 35	$ 29
PICKUPS (O&M ELSEWHERE)	$ 18,000	$ 34.039	$ 52.039	$ 9.763	$ 18 463	$ 28,226	$ 23.813
SERVICE TRUCK	$ 9,049	$ 1.122	$ 10,171	$ 7,218	$ 609	$ 7,827	$ 2.344
TRACK BACKHOE 1 1/4 CY 148 HP	$ 15.553	$ 5,899	$ 21.452	$ 14.638	$ 3,200	$ 17,837	$ 3,615
LOAOER/BACKHOE 1 1/4 CY	$ 6,945	$ 2.405	$ 9.350	$ 6,030	$ 1,304	$ 7,334	$ 2,016
OUMP TRUCK INTERNATIONAL 3AX, 240 HP	$ 15,219	$ 4.312	$ 19,532	$ 14.304	$ 2,339	$ 16,643	$ 2.889
SEMI TRACTOR	$ 16,052	$ 4.104	$ 20,156	$ 14.222	$ 2.226	$ 16.448	$ 3.708
LOWBOY TRAILER, 40 T. 3AX, OROP NECK	$	$ 1,154	$ 1.154	$ -	$ 626	$ 626	$ 528
PORTABLE TRASH PUMPS	$ -	$ 160	$ 160	$	$ 87	$ 87	$ 73
FARM TRACTOR JD2555. 72 HP & ACCESS	$ 4.662	$ 962	$ 5.624	$ 2,662	$ 522	$ 3.184	$ 2.440
SUBTOTAL	$ 85,480	$ 57,156	$ 142,635	$ 68,837	$ 31,001	$ 99,838	$ 42,798
ADMINISTRATION (CTS ESTIMATES)							
BOARO OF OIRECTORS(# EA*2DAY/MO*12MO*8HR/DAY*$33 75/HR)	$ 29,808		$ 29,808	$ 22,356		$ 22,356	$ 7,452
BOARD OF DIR -AT LARGE(# EA*1DAY/MO*12MO*8HR/DAY*$20 25/HR)	$ 13,414		$ 13,414	$ 8,942		$ 8,942	$ 4.471
SYSTEM MANAGER(2080 HRS*$25/HR*1 35 ERINGE)	$ 80,730		$ 80,730	$ 80,730		$ 80.730	$ -
BOOK KEEPER(2080 HRS*$12/HR*1 35 FRINGE)	$ 38,750		$ 38,750	$ 38,750		$ 38,750	$ -
SECRETARY(2080 HRS*$9/HR*1 35 ERINGE)	$ 29,063		$ 29,063	$ 29,063		$ 29,063	$ -
ADMIN BUILOING UTILITIES($300/MO)	$ 4,140		$ 4,140	$ 4,140		$ 4,140	$ -
[2]RAOIO SYSTEM	$ 3,450		$ 3,450	$ 3,450		$ 3.450	$ -
REFUSE COLLECTION	$ 1,380		$ 1,380	$ 1,380		$ 1.380	$ -
OFFICE SUPPLIES	$ 2,300		$ 2,300	$ 1,725		$ 1,725	$ 575
PRINTING	$ 575		$ 575	$ 575		$ 575	$ -
SAEETY SUPPLIES	$ 2,300		$ 2,300	$ 1,725		$ 1,725	$ 575
POSTAGE	$ 575		$ 575	$ 575		$ 575	$ -
PUBLICATIONS	$ 1,150		$ 1,150	$ 1,150		$ 1,150	$ -
TELEPHONE	$ 5,750		$ 5,750	$ 5,750		$ 5,750	$ -
INSURANCE	$ 57,500		$ 57,500	$ 11,500		$ 11,500	$ 46.000
TRAINING	$ 11,500		$ 11,500	$ 11,500		$ 11.500	$ -
LEGAL SERVICES	$ 28,750		$ 28,750	$ 17,250		$ 17.250	$ 11,500
ACCOUNTING SERVICES	$ 11,500		$ 11,500	$ 9,200		$ 9,200	$ 2.300
ENGINEERING/ARCHITECIITURAL SERVICES	$ 28,750		$ 28,750	$ 23,000		$ 23.000	$ 5.750
GENERAL EXPENSE	$ 11,500		$ 11,500	$ 9,200		$ 9.200	$ 2.300
TRAVEL - MANAGER($50/DAY*2 DAY/MO*12 MO)	$ 1,380		$ 1,380	$ 1,380		$ 1,380	$ -
TRAVEL - O&M SUPERVISOR ($50/DAY*2DAY/MO*12MO)	$ 1,380		$ 1,380	$ 1,380		$ 1,380	$ -
BOARD OF DIRECTORS($50/DAY*2DAY/MO*#MEMBERS)	$ 5,520		$ 5,520	$ 4,140		$ 4,140	$ 1.380
VEHICLE O&M COSTS (1 EA *15000 MI*$0 45/MI)	$ 7,763		$ 7,763	$ 7,763		$ 7,763	$ -
SUBTOTAL	$ 378,927	$ -	$ 378,927	$ 296,624	$ -	$ 296,624	$ 82,303
NON-INDIAN WATER PURCHASE @ $15/AE/YR	$ 89,055		$ 89,055	$ -		$ - $ -	$ 89,055
TOTAL DESIGN YEAR O&M	$ 2,200,428	$ 563,798	$ 2,764,225	$ 1,164,892	$ 247,500	$ 1,412,393	$ 1,351,832
ANNUAL ELECTRICAL COST	$ 450,344			$ 172.089			$ 278.255

[1] SEE SUMMARY TABLES FOR RESERVATION PORTION OF INTAKE AND WTP COSTS FOR ANNUAL POWER COSTS BY DECADE AND PRESENT VALUE OF POWER COSTS

[2] BASED ON BILLINGS WATER TREATMENT PLANT ANNUAL EXPENSES

[3] REFER TO INTAKE POWER COST TABLES FOR INDIAN ONLY DEMANDS FOR PV OF ANNUAL POWER COSTS

TABLE 10-2 REGIONAL WATER SYSTEM OPERATION, MAINTENANCE, AND REPLACEMENT COSTS

INTEREST % 5.63
INFLATION % 3.00
YEARS 50

INDIAN(CORE) COMPONENTS NON-CONTRACT PERCENTAGE= 33%
NON-INDIAN COMPONENTS NON-CONTRACT PERCENTAGE= 28%

	[1] PROJECT COST $	USEFUL LIFE YEARS	NO OF REPLAC-MENTS #	1st COST PV $	2nd COST PV $	REPLACEMENT # 3rd COST PV $	4th COST PV $	5th COST PV $	6th COST PV $	TOTAL REPLACEMENT COST PV [3] $	SALVAGE PV $	O&M DESIGN YR $	O&M PV $	TOTAL LIFE CYCLE COST $
RAW WATER INTAKE, PUMP STATION, AND WTP [3]														
Intake & Raw Water Pump Station	7,771,190	25	1	778,643	-	-	-	-	-					
Site (includes raw water pipeline)	7,775,180	50	0	-	-	-	-	-	-	778,643	-	84,640	2,308,227	10,858,060
Pretreatment	8,438,850	25	1	845,540	-	-	-	-	-	-	-	-	-	7,775,180
Filter Building	9,462,950	25	1	948,151	-	-	-	-	-	845,540	-	41,126	1,121,545	10,405,935
Clearwell	3,420,760	50	0	-	-	-	-	-	-	948,151	-	78,163	2,131,599	12,542,700
High Service Pump Station	7,574,350	25	1	758,921	-	-	-	-	-	-	-	-	-	3,420,760
Chemical Building	6,772,360	25	1	678,564	-	-	-	-	-	758,921	-	148,269	4,043,456	12,376,726
Recovery Pump Station	1,963,080	25	1	196,693	-	-	-	-	-	678,564	-	429,188	11,704,399	19,155,323
Ponds	2,874,130	50	0	-	-	-	-	-	-	196,693	-	28,247	770,327	2,930,100
Administration/Maintenance Building	2,409,960	50	0	-	-	-	-	-	-	-	-	183,332	4,999,662	7,873,792
SUBTOTAL	58,462,810			4,206,512	-	-	-	-	-	-	-	74,864	2,041,631	4,451,591
										4,206,512	-	1,067,830	29,120,846	91,790,168
PIPELINES														
O&M Personnel														
CORE PIPELINE (TIBER TO ROCKY BOY'S)	29,503,453	50	0	-	-	-	-	-	-			156,407	-	
(NON-CORE) REGIONAL SYSTEM PIPELINES	65,312,206	50	0	-	-	-	-	-	-	-	-	6,900	188,170	29,691,823
(CORE) RESERVATION SYSTEM PIPELINES	12,113,983	50	0	-	-	-	-	-	-	-	-	23,000	627,234	85,939,440
SUBTOTAL	106,929,642			-	-	-	-	-	-	-	-	5,750	156,808	12,270,791
										-	-	192,057	972,212	107,901,854
PIPELINES CATHODIC PROTECTION														
CORE PIPELINE	830,563	50	0	-	-	-	-	-	-					
(NON-CORE) REGIONAL SYSTEM PIPELINES	1,608,963	50	0	-	-	-	-	-	-	-	-	-	-	830,563
(CORE) RESERVATION TRANSMISSION PIPELINES	224,069	50	0	-	-	-	-	-	-	-	-	-	-	1,608,963
SUBTOTAL	2,663,594			-	-	-	-	-	-	-	-	-		224,069
										-	-	-	-	2,683,594
CROSSINGS/LAND AQUISITION														
CORE PIPELINE CROSSINGS	277,602	50	0	-	-	-	-	-	-					
CORE PIPELINE R.O.W. AQUISITION	329,446									-	-	-	-	277,602
(NON-CORE) REGIONAL SYSTEM CROSSINGS	8,103,813	50	0	-	-	-	-	-	-			-	-	
NON-CORE) REGIONAL SYSTEM R.O.W. AQUISITION	2,056,037									-	-	-	-	8,103,813
(CORE) ON-RESERVATION SYSTEM CROSSINGS	1,053,527	50	0	-	-	-	-	-	-			-	-	
RE) ON-RESERVATION SYSTEM R.O.W. AQUISITION	75,607									-	-	-	-	1,053,527
SUBTOTAL	11,896,033			-	-	-	-	-	-			-	-	
										-	-	-	-	11,898,033
APPURTENANCES														
ORE PIPELINE ISOLATION VALVES	391,076	30	1	138,205	-	-	-	-	-					0
AIR VAC/RELEASE VALVES & MH'S	297,011	25	1	119,037	-	-	-	-	-	138,205	46,068	-	-	483,212
FLUSH HYDRANTS	275,810	20	2	125,363	75,784	-	-	-	-	119,037	-	-	-	418,048
ON-CORE) REGIONAL SYSTEM - ISOLATION VALVES	619,085	30	1	227,329	-	-	-	-	-	201,147	37,892	-	-	439,065
AIR VAC/RELEASE VALVES & MH'S	1,124,265	25	1	468,189	-	-	-	-	-	227,329	75,776	-	-	770,637
FLUSH HYDRANTS	745,813	20	2	352,233	212,932	-	-	-	-	468,189	-	-	-	1,592,454
METER VAULTS	582,912	30	1	214,046	-	-	-	-	-	565,165	106,466	-	-	1,204,512
(CORE) RES. TRANS. SYSTEM - ISOLATION VALVES	129,054	25	1	51,723	-	-	-	-	-	214,046	71,349	-	-	725,610
AIR VAC/RELEASE VALVES & MH'S	495,225	20	2	225,092	136,073	-	-	-	-	51,723	-	-	-	180,777
FLUSH HYDRANTS	198,729	30	1	70,230	-	-	-	-	-	361,165	68,036	-	-	788,354
METER VAULTS	26,334	30	1	9,306	-	-	-	-	-	70,230	23,410	-	-	245,549
SUBTOTAL	4,885,313			2,000,755	424,788	-	-	-	-	9,306	3,102	-	-	32,538
										2,425,543	432,100	-	-	8,878,756
PUMP STATIONS [3]														
(NON-CORE) REGIONAL SYSTEM PUMPING														
RG#1 -High Service Pump Station (see note 4)												209,079	5,701,812	5,701,812
RG#2	442,675	25	2	46,087	24,566	-	-	-	-			-	-	
RG#3	86,170	25	2	8,971	4,782	-	-	-	-	70,653	-	-	-	513,328
RG#4	255,130	25	2	26,562	14,158	-	-	-	-	13,753	-	-	-	99,923
RG#5	263,578	25	2	27,441	14,627	-	-	-	-	40,720	-	-	-	295,850
RG#6	1,412,506	25	2	147,056	78,387	-	-	-	-	42,068	-	-	-	305,646
RG#7	314,266	25	2	32,718	17,440	-	-	-	-	225,443	-	-	-	1,637,949
RG#8	162,202	25	2	16,887	9,001	-	-	-	-	50,158	-	-	-	364,424
RG#9	1,380,403	25	2	143,714	76,606	-	-	-	-	25,888	-	-	-	188,090
RG#10	838,042	25	2	87,249	46,507	-	-	-	-	220,320	-	-	-	1,600,723
RG#11	136,858	25	2	14,248	7,595	-	-	-	-	133,756	-	-	-	971,797
RG#12	160,512	25	2	16,711	8,908	-	-	-	-	21,843	-	-	-	158,701
RG#13	821,146	25	2	85,490	45,570	-	-	-	-	25,619	-	-	-	186,131
RG#14a	299,059	25	2	31,135	16,596	-	-	-	-	131,059	-	-	-	952,205
RG#14b	302,438	25	2	31,487	16,784	-	-	-	-	47,731	-	-	-	346,791
(CORE) RESERVATION TRANSMISSION PUMPING										48,271	-	-	-	350,709
PS#1-E	926,957	25	2	92,877	49,508	-	-	-	-			67,516	1,841,230	1,841,230
PS#1N	763,686	25	2	76,518	40,788	-	-	-	-	142,385	-	-	-	1,089,342
PS#2	926,957	25	2	92,877	49,508	-	-	-	-	117,306	-	-	-	880,992
PS#3	809,332	25	2	81,092	43,225	-	-	-	-	142,385	-	-	-	1,089,342
PS#4	781,242	25	2	78,277	41,725	-	-	-	-	124,317	-	-	-	933,849
[illegible]	[illegible]	25	2	19,549	10,314	-	-	-	-	120,003	-	-	-	901,245
PS#6	115,870	25	2	11,610	6,188	-	-	-	-	29,664	-	-	-	222,780
SUBTOTAL	11,392,141			1,168,357	622,785	-	-	-	-	17,798	-	-	-	133,668
										1,791,141	-	276,595	7,543,042	20,726,324
STORAGE FACILITIES														
CORE SYSTEM STORAGE (See note 5)		50	0	-	-	-	-	-	-					
NON-CORE REGIONAL SYSTEM		50	0	-	-	-	-	-	-	-	-	17,710	482,970	482,970
T-B1	991,795	50	0	-	-	-	-	-	-	-	-	41,170	1,122,749	1,122,749
T-B2	604,877	50	0	-	-	-	-	-	-	-	-	-	-	991,795
T-G	985,037	50	0	-	-	-	-	-	-	-	-	-	-	604,877
T-H	223,027	50	0	-	-	-	-	-	-	-	-	-	-	985,037
J1	576,154	50	0	-	-	-	-	-	-	-	-	-	-	223,027
J2	59,136	50	0	-	-	-	-	-	-	-	-	-	-	576,154
J3	762,010	50	0	-	-	-	-	-	-	-	-	-	-	59,136
N	223,027	50	0	-	-	-	-	-	-	-	-	-	-	762,010
(CORE) RESERVATION SYSTEM STORAGE		50	0	-	-	-	-	-	-	-	-	-	-	223,027
Mainline Tank #1	840,932	50	0	-	-	-	-	-	-	-	-	14,260	388,885	388,885
Lwr DF	933,979	50	0	-	-	-	-	-	-	-	-	-	-	840,932
Box Elder Village (Existing)	-	50	0	-	-	-	-	-	-	-	-	-	-	933,979
Laredo West Tank	2,317,392	50	0	-	-	-	-	-	-	-	-	-	-	0
Laredo Road Tank	598,660	50	0	-	-	-	-	-	-	-	-	-	-	2,317,392
Mainline Tank #2	1,264,032	50	0	-	-	-	-	-	-	-	-	-	-	598,660
RBA Tank #1	969,091	50	0	-	-	-	-	-	-	-	-	-	-	1,264,032
Haystack Tank	1,011,226	50	0	-	-	-	-	-	-	-	-	-	-	969,091
Parker School Tank	598,660	50	0	-	-	-	-	-	-	-	-	-	-	1,011,226
Newtown Tank	1,000,692	50	0	-	-	-	-	-	-	-	-	-	-	598,660
Bonneville Tank	709,262	50	0	-	-	-	-	-	-	-	-	-	-	1,000,692
Duck Creek Tank	918,179	50	0	-	-	-	-	-	-	-	-	-	-	709,262
Bear Creek Tank	867,266	50	0	-	-	-	-	-	-	-	-	-	-	918,179
SUBTOTAL	16,454,434			-	-	-	-	-	-	-	-	-	-	867,266
										-	-	73,140	1,994,604	18,449,037
TELEMETRY														
CORE SYSTEM	175,560	50	0	-	-	-	-	-	-					
(NON-CORE) REGIONAL SYSTEM	1,790,976	50	0	-	-	-	-	-	-	-	-	-	-	175,560
(CORE) ON-RESERVATION SYSTEM	702,240	50	0	-	-	-	-	-	-	-	-	-	-	1,790,976
SUBTOTAL	2,668,776			-	-	-	-	-	-	-	-	-	-	702,240
										-	-	-	-	2,668,776
POWER DELIVERY FACILITIES/LINES														
CORE POWER LINES	184,265	50	0	-	-	-	-	-	-					
(NON-CORE) REGIONAL SYSTEM POWER LINES	1,258,668	50	0	-	-	-	-	-	-	-	-	-	-	184,265
(CORE) RESERVATION POWER LINES	92,132	50	0	-	-	-	-	-	-	-	-	-	-	1,258,668
SUBTOTAL	1,535,065			-	-	-	-	-	-	-	-	-	-	92,132
										-	-	-	-	1,535,065
MAINTENANCE EQUIP. (CTS ESTIMATES)														
TOOLS	26,600	15	3	13,712	9,400	6,445	-	-	-					
BENCHES & EQUIPMENT	6,650	15	3	3,428	2,350	1,611	-	-	-	29,557	4,296	-	-	51,860
COMPUTER EQUIPMENT	6,650	10	4	3,888	3,023	2,350	1,827	-	-	7,389	1,074	-	-	12,965
METER READING EQUIPMENT	665	15	3	343	235	161	-	-	-	11,087	-	-	-	17,737
OFFICE EQUIP. & FURN.	2,660	25	1	1,066	-	-	-	-	-	739	107	-	-	1,297
[2] PICKUPS	239,400	8	6	147,176	120,337	98,393	80,450	65,780	53,784	1,066	-	-	-	3,726
SERVICE TRUCK	46,550	25	1	18,657	-	-	-	-	-	565,921	-	18,000	490,879	1,232,360
TRACK BACKHOE 1 1/4 CY 148 HP	244,720	25	1	98,080	-	-	-	-	-	18,657	-	9,049	246,762	2,056,395
LOADER/BACKHOE 1 1/4 CY	99,750	25	1	39,978	-	-	-	-	-	98,080	-	15,553	424,140	1,224,460
DUMP TRUCK INTERNATIONAL 3AX, 240 HP	178,885	25	1	71,694	-	-	-	-	-	39,978	-	6,945	189,397	2,898,152
SEMI TRACTOR	170,240	25	1	68,230	-	-	-	-	-	71,694	-	15,219	360,503	432,197
LOWBOY TRAILER, 40 T, 3AX, DROP NECK	47,880	25	1	19,190	-	-	-	-	-	68,230	-	16,052	328,671	396,900
PORTABLE TRASH PUMPS	6,650	25	1	2,665	-	-	-	-	-	19,190	-	-	-	203,454
FARM TRACTOR JD2555, 72 HP & ACCESS	39,900	25	1	15,991	-	-	-	-	-	2,665	-	-	-	1,261,333
SUBTOTAL	1,117,200			504,096	135,345	108,960	82,278	65,780	53,784	15,991	-	4,662	127,144	235,268
										950,244	5,478	85,480	2,167,495	4,647,326
NON-INDIAN WAER PURCHASE														
5937 acre-ft per year @ $15/acre-ft														
												89,055	2,428,622	
DMINISTRATION and METER READERS														
(Design Year O&M from Table 10-1)														
												416,270	11,352,118	11,378,718
TOTAL	218,005,008			7,879,720	1,182,919	108,960	82,278	85,780	53,784	9,373,441	437,578	2,200,428	55,578,938	280,535,851

[1] PROJECT COSTS INCLUDE 10% UNLISTED ITEMS, 10% MOBILIZATION, DEMOBILIZATION, TAXES, BONDS, & INSURANCE, 10% CONTINGENCY, 32% NON-CONTRACT COSTS(CORE):

[2] 6 PICKUPS FOR REGIONAL SYSTEM (MNGR, WTP SUPR, WTP O&M PERSON, METER READER, 2 TRANS/DISTR. MAINT.)

[3] THE REPLACEMENT COSTS FOR ALL INTAKE, TREATMENT, AND PUMPING STATION COMPONENTS ASSUMES THAT THE REPLACEMENT CONSISTS OF A RENOVATION AT 25 PERCENT OF THE ORIGINAL FIELD COST

[4] THE COSTS FOR THE HIGH SERVICE PUMP STATION (RG#1) IS INCLUDED IN THE WATER TREATMENT PLANT COSTS

[5] THE COSTS FOR THE CORE SYSTEM STORAGE IS INCLUDED IN THE WATER TREATMENT PLANT COSTS

DESIGN YEAR OPERATIONS, MAINTENANCE, AND REPLACEMENT COSTS

	REGIONAL SYSTEM			INDIAN ONLY SYSTEM			
	ANNUAL O&M COSTS	ANNUAL REPLACEMENT COSTS	ANNUAL OM&R COSTS	ANNUAL O&M COSTS	ANNUAL REPLACEMENT COSTS	ANNUAL OM&R COSTS	NON-INDIAN ANNUAL OM&R COSTS
INT							
W WATER PUMP STATION	$ 20,304	$ 46,834	$ 67,138	$ 11,013	$ 25,403	$ 36,416	$ 30,722
POWER	$ 64,336		$ 64,336	$ 34,896		$ 34,896	$ 29,440
PRETREATMENT	$ 17,451	$ 50,858	$ 68,309	$ 9,465	$ 27,585	$ 37,051	$ 31,258
POWER	$ 23,675		$ 23,675	$ 12,841		$ 12,841	$ 10,834
FILTER BUILDING	$ 76,460	$ 57,030	$ 133,490	$ 41,472	$ 30,933	$ 72,405	$ 61,085
POWER	$ 1,704		$ 1,704	$ 924		$ 924	$ 780
CLEARWELL	$ -	$ -	$ -	$ -	$ -	$ -	$ -
VICE PUMP STATION	$ 39,098	$ 45,648	$ 84,746	$ 21,207	$ 24,759	$ 45,966	$ 38,780
POWER	$ 109,172		$ 109,172	$ 59,215		$ 59,215	$ 49,957
HEMICAL BUILDING	$ 425,608	$ 40,815	$ 466,423	$ 230,850	$ 22,138	$ 252,988	$ 213,435
POWER	$ 3,580		$ 3,580	$ 1,942		$ 1,942	$ 1,638
ER PUMP STATION	$ 16,829	$ 11,831	$ 28,660	$ 9,128	$ 6,417	$ 15,545	$ 13,115
POWER	$ 11,418		$ 11,418	$ 6,193		$ 6,193	$ 5,225
PONDS	$ 183,332	$ -	$ 183,332	$ 99,439	$ -	$ 99,439	$ 83,893
ANCE BUILDING	$ 74,750	$ -	$ 74,750	$ 40,544	$ -	$ 40,544	$ 34,206
Power	$ 114		$ 114	$ 62		$ 62	$ 52
SUBTOTAL	$ 1,067,830	$ 253,015	$ 1,320,846	$ 579,191	$ 137,235	$ 716,427	$ 604,419
RAL EXPENSE	$ 11,500		$ 11,500	$ 9,200		$ 9,200	$ 2,300
Y/MO*12 MO)	$ 1,380		$ 1,380	$ 1,380		$ 1,380	$ -
T Y/MO*12MO)	$ 1,380		$ 1,380	$ 1,380		$ 1,380	$ -
B #MEMBERS)	$ 5,520		$ 5,520	$ 4,140		$ 4,140	$ 1,380
1I*$0 45/MI)	$ 7,763		$ 7,763	$ 7,763		$ 7,763	$ -
UBTOTAL	$ 378,927	$ -	$ 378,927	$ 296,624	$ -	$ 296,624	$ 82,303
15/AF/YR	$ 89,055		$ 89,055	$ -		$ - $ -	$ 89,055
R O&M	$ 2,200,428	$ 563,798	$ 2,764,225	$ 1,164,892	$ 247,500	$ 1,412,393	$ 1,351,832
COST	$ 450,344			$ 172,089			$ 278,255

[1] SEE SUMMARY TABLES FOR COSTS FOR ANNUAL POWER COSTS BY DECADE AND PRESENT VALUE OF POWER COSTS

[2] BASED ON BILLINGS WATER

[3] REFER TO INTAKE POWER CO V OF ANNUAL POWER COSTS

TABLE 10-3 OFF RESERVATION PUMPING STATION, WTP, AND INTAKE POWER REQUIREMENT SUMMARY

Pressure Zone	Pump ID	Model Pump	Average Water HP	Peak Water HP	Average Pump HP (total efficiency = 60%)	Peak Pump HP (total efficiency=60%)[1]	Average Electrical Power Required (KW)[2]	Peak Electrical Power Required (KW)[2]	Average Annualized Energy (KW*hr)
A	RG#1 [3]	E1	20	225	33	375	125	380	1,093,744
B	RG#1	W1	75	350	125	583	193	535	1,692,542
C	RG#2	TCWD	10	45	17	75	112	156	984,872
D	RG#3	RC	0.2	1	0	2	100	101	878,177
E	RG#4	Loma	5	25	8	42	106	131	930,436
F	RG#5	HCWD	2.5	35	4	58	103	143	903,218
G	RG#6	Pump-2W	100	400	167	667	224	597	1,964,722
H	RG#7	1-N	25	35	42	58	131	143	1,148,181
I	RG#8	2-N	10	29	27	48	120	136	1,050,196
J	RG#9	Pump-4W	50	350	83	583	162	535	1,420,361
K	RG#10	1-SW	20	100	33	167	125	224	1,093,744
L	RG#11	1-NW	2.6	7	1	12	101	109	881,444
M	RG#12	3N	2.6	13	4	22	103	116	904,307
N	RG#13	CB1	10	200	67	333	150	349	1,311,489
(5)	RG#14a	InvernessP1	5.6	28	9	47	107	135	936,968
(5)	RG#14b	InvernessP2	5.6	28	9	47	107	135	936,968
Intake	N/A	N/A	N/A	N/A	414	1,044	257	879	2,247,790
WTP	N/A	N/A	N/A	N/A	N/A	N/A	1,061	1504	9,294,360
Total			324.2	1602			3,807	6,308	29,673,519

[1] Power calculations assume a 75% pump efficiency and an 80% motor efficiency.

[2] Total Power Required includes 100KW for each pump station for other electrical items

[3] Average Power Calculations are estimated due to the fact that pumps are only required to run at peak flow conditions.

[4] Power calculations are based upon a percentage of average to peak power requirements of other pumps (approximately 20%)

[5] Pumping Stations RG#14a and RG#14b will deliver water to the Hill County Water District through the existing Inverness pipeline.

TABLE 10-4 ON-RESERVATION PUMPING STATION POWER REQUIREMENT SUMMARY

Pressure Zone	Pump ID	Average Water HP	Peak Water HP	Average Pump HP (total efficiency=60%)	Peak Pump HP (total efficiency=60%)[1]	Average Electrical Power Required (KW)	Peak Electrical Power Required (KW)[2]	Average Annualized Energy (KW*hr)
1	PS#1-E	145	257	242	428	280	419	2,454,647
2	PS#1N	20	43	33	72	125	153	1,093,744
3	PS#2	162	309	270	515	301	484	2,639,730
4	PS#3	68	151	113	252	185	288	1,616,331
5	PS#4	50	117	83	195	162	245	1,420,361
6	PS#5	1	9	2	15	102	111	890,807
7	PS#6	9	27	15	45	111	134	970,719
Total		455	913	758	1522	1266	1835	11,086,338

[1] Power calculations assume a 75% pump efficiency and an 80% motor efficiency.

[2] Total Power Required includes 100KW for each pump station for other electrical items

10.3 REPLACEMENT OF SYSTEM COMPONENTS

The useful lives for each of the system components was estimated and the replacement costs included for those components with useful lives less than 50 years. The replacement costs for these components were included to ensure an efficient and operational system through the 50-year life of the project. The development of replacement costs is shown in Table 10-2. Since the system will be new and not require replacement of components for a number of years and the rate structure will include this component from the start of the project, it will act as an emergency fund.

10.4 LABOR COSTS

The labor costs include an allowance for fringe benefits of 35 percent of the base wages paid to the employee. The wages estimated for the permanent employees was based on wages paid for personnel with similar duties and responsibilities at other treatment facilities in Montana. In addition to operations and maintenance staff for both the treatment plant and the transmission system, staff was included for reading meters, a system manager, bookkeeper, secretary, and a board of directors.

10.5 OPERATION AND MAINTENANCE MANUAL

As part of this project, a complete operation and maintenance (O&M) manual will be prepared prior to the treatment plant becoming operational. It will not only cover the treatment plant components but also the pumping, storage, transmission systems. In addition to the detailed description of the operation and maintenance procedures, this O&M manual will include inspection and maintenance standards, personnel qualifications, and licensing standards. The construction contracts for the critical equipment will include appropriate spare parts and the O&M manual will include the suggested spare parts inventory to maintain at all times. Additionally, local rental of critical repair equipment (such as excavators, tractors, pumps, etc.) will be researched and agreements put in place to allow for quick rental of this supplementary repair equipment.

10.6 OPERATION, MAINTENANCE, AND REPLACEMENT RESPONSIBILITIES

Public Law 107-331 describes agreements that will be entered into by various parties to this project. Among these is a tri-partite agreement between the Authority, Tribe, and Secretary (of Interior) that will address OM&R. Discussions have begun to prepare these agreements.

> ***SEC. 904. ROCKY BOY'S RURAL WATER SYSTEM.***
>
> *(b) Core System.—*
>
> *(1) In General. —The Secretary is authorized to plan, design, construct, operate, maintain, and replace the core system.*
>
> *(c) Operation, Maintenance, and Replacement (OM&R) Core System. —The cost of operation, maintenance, and replacement of the core system shall be allocated as follows—*
>
> *(1) 100 percent of the Tribe's share of the OM&R costs, as negotiated in the Agreements, shall be funded through the Chippewa Cree Water System Operation, Maintenance, and Replacement Trust Fund established in section 913;*
>
> *(2) 100 percent of the Authority's share of the OM&R costs, as negotiated in the Cooperative Agreements, shall be funded by the Authority and fully reimbursable to the Secretary.*
>
> ***SEC. 905. NONCORE SYSTEM.***
>
> *(b) Federal Share.—*
>
> *(1) Planning, Design, and Construction.—The Federal share of the cost of planning, design, and construction of the noncore system shall be 80 percent and will be funded through annual appropriations to the Bureau of Reclamation.*
>
> *(2) Operation, Maintenance, and Replacement of Noncore System Components.—The cost of operation, maintenance, and replacement associated with water deliveries to the noncore system shall not be a Federal responsibility and shall be borne by the Authority.*
>
> *(d) Cooperative Agreements.—*
>
> *(1) In General.—The Secretary is authorized to enter into the Cooperative Agreements with the Authority to provide Federal funds and necessary assistance for the planning, design, and construction of the noncore system. The Secretary is further authorized to enter into a tri-partite Cooperative Agreement with the Authority and the Tribe addressing the allocation of operation, maintenance and replacement costs for the core system and action that can be undertaken to keep those costs within reasonable levels.*

The Authority's share of OM&R costs is estimated to be $0.69 per 1000 gallons. In addition, the Authority will have to repay loans obtained to pay their share of construction costs. Individual systems will continue to pay remaining OM&R costs associated with their systems and remaining debt.

APPENDIX A

FEDERAL LEGISLATION

TITLE IX—ROCKY BOY'S RURAL WATER SYSTEM

Rocky Boy's/
North Central
Montana
Regional Water
System Act of
2002.

SEC. 901. SHORT TITLE.

This title may be cited as the "Rocky Boy's/North Central Montana Regional Water System Act of 2002".

SEC. 902. FINDINGS AND PURPOSES.

(a) FINDINGS.—Congress finds that—

(1) the water systems serving residents of the Rocky Boy's Reservation in the State of Montana—

(A) do not meet minimum health and safety standards;

(B) pose a threat to public health and safety; and

(C) are inadequate to supply the water needs of the Chippewa Cree Tribe;

(2) the United States has a responsibility to ensure that adequate and safe water supplies are available to meet the economic, environmental, water supply, and public health needs of the Reservation;

(3) the entities administering the rural and municipal water systems in North Central Montana are having difficulty complying with regulations promulgated under the Safe Drinking Water Act (42 U.S.C. 300f et seq.); and

(4) the study, defined in section 903(k), identifies Lake Elwell, near Chester, Montana, as an available, reliable, and safe rural and municipal water supply for serving the needs of the Reservation and North Central Montana.

(b) PURPOSES.—The purposes of this title are—

(1) to ensure a safe and adequate rural, municipal, and industrial water supply for the residents of the Rocky Boy's Reservation in the State of Montana;

(2) to assist the citizens residing in Chouteau, Glacier, Hill, Liberty, Pondera, Teton, and Toole Counties, Montana,

but outside the Reservation, in developing safe and adequate rural, municipal, and industrial water supplies;

(3) to authorize the Secretary of the Interior—

(A) acting through the Commissioner of Reclamation to plan, design, and construct the core and noncore systems of the Rocky Boy's/North Central Montana Regional Water System in the State of Montana; and

(B) acting through the Bureau of Indian Affairs to operate, maintain, and replace the core system and the on-Reservation water distribution systems, including service connections to communities and individuals; and

(4) to authorize the Secretary, at the request of the Chippewa Cree Tribe, to enter into self-governance agreements with the Tribe under title IV of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 458aa et seq.), under which the Tribe—

(A) through the Bureau of Reclamation, will plan, design, and construct the core system of the Rocky Boy's/North Central Montana Regional Water System, and

(B) through the Bureau of Indian Affairs, will operate, maintain, and replace (including service connections to communities and individuals) the core system and the on-Reservation water distribution systems.

SEC. 903. DEFINITIONS.

In this title:

(1) AUTHORITY.—The term "Authority" means the North Central Montana Regional Water Authority established under State law, Mont. Code Ann. Sec. 75–6–301, et. seq. (2001), to allow public agencies to join together to secure and provide water for resale.

(2) CORE SYSTEM.—The term "core system" means a component of the water system as described in section 904(d) and the final engineering report.

(3) FINAL ENGINEERING REPORT.—The term "final engineering report" means the final engineering report prepared for the Rocky Boy's/North Central Montana Regional Water System, as approved by the Secretary of the Interior.

(4) FUND.—The term "fund" means the Chippewa Cree Water System Operation, Maintenance, and Replacement Trust Fund.

(5) ON-RESERVATION WATER DISTRIBUTION SYSTEMS.—The term "on-reservation water distribution systems" means that portion of the Rocky Boy's/North Central Montana Regional Water system served by the core system and within the boundaries of the Rocky Boy's Reservation. The on-reservation water distribution systems are described in section 904(f) and the final engineering report.

(6) NONCORE SYSTEM.—The term "noncore system" means the rural water system for Chouteau, Glacier, Hill, Liberty, Pondera, Teton, and Toole Counties, Montana, described in section 905(c) and the final engineering report.

(7) RESERVATION.—

(A) IN GENERAL.—The term "Reservation" means the Rocky Boy's Reservation in the State of Montana.

(B) INCLUSIONS.—The term "Reservation" includes all land and interests in land that are held in trust by the

United States for the Tribe at the time of the enactment of this title.

(8) ROCKY BOY'S/NORTH CENTRAL MONTANA REGIONAL WATER SYSTEM.—The term "Rocky Boy's/North Central Montana Regional Water System" means—

(A) the core system;

(B) the on-reservation water distribution systems; and

(C) the non-core system.

(9) SECRETARY.—The term "Secretary" means the Secretary of the Interior.

(10) STATE.—The term "State" means the State of Montana.

(11) STUDY.—The term "study" means the study entitled "North Central Montana Regional Water System Planning/Environmental Report" dated May 2000.

(12) TRIBE.—The term "Tribe" means—

(A) the Chippewa Cree Tribe of the Rocky Boy's Reservation; and

(B) all officers, agents, and departments of the Tribe.

SEC. 904. ROCKY BOY'S RURAL WATER SYSTEM.

(a) FINAL ENGINEERING REPORT.—The following reports will serve as the basis for the final engineering report for the Rocky Boy's/North Central Montana Regional Water System—

(1) pursuant to Public Law 104–204, a study, described in section 903(k), that was conducted to study the water and related resources in North Central Montana and to evaluate alternatives for providing a municipal, rural and industrial supply of water to the citizens residing in Chouteau, Glacier, Hill, Liberty, Pondera, Teton, and Toole Counties, Montana, residing both on and off the Reservation; and

(2) pursuant to section 202 of Public Law 106–163, the Tribe has conducted, through a self-governance agreements with the Secretary of the Interior, acting through the Bureau of Reclamation, a feasibility study to evaluate alternatives for providing a municipal, rural and industrial supply of water to the Reservation.

The Secretary of the Interior may require, through the agreements described in subsection (g) and section 905(d), that the final engineering report include appropriate additional study and analyses.

(b) CORE SYSTEM.—

(1) IN GENERAL.—The Secretary is authorized to plan, design, construct, operate, maintain, and replace the core system.

(2) FEDERAL SHARE.—

(A) The Federal share of the cost of planning, design, and construction of the core system shall be—

(i) 100 percent of the Tribal share of costs as identified in section 914;

(ii) 80 percent of the authority's share of the total cost for the core system as identified in section 914; and

(iii) funded through annual appropriations to the Bureau of Reclamation.

(3) AGREEMENTS.—Federal funds made available to carry out this subsection may be obligated and expended only in

accordance with the Agreements entered into under subsection (g).

(c) Operation, Maintenance, and Replacement (OM&R) CORE SYSTEM.—The cost of operation, maintenance, and replacement of the core system shall be allocated as follows—

(1) 100 percent of the Tribe's share of the OM&R costs, as negotiated in the Agreements, shall be funded through the Chippewa Cree Water System Operation, Maintenance, and Replacement Trust Fund established in section 913;

(2) 100 percent of the Authority's share of the OM&R costs, as negotiated in the Cooperative Agreements, shall be funded by the Authority and fully reimbursable to the Secretary.

Federal funds made available to carry out this subsection may be obligated and expended only in accordance with the Agreements entered into under subsection (g) and section 905(d).

(d) CORE SYSTEM COMPONENTS.—As described in the final engineering report, the core system shall consist of—

(1) intake, pumping, water storage, and treatment facilities;

(2) transmission pipelines, pumping stations, and storage facilities;

(3) appurtenant buildings, maintenance equipment, and access roads;

(4) all property and property rights necessary for the facilities described in this subsection;

(5) all interconnection facilities at the core pipeline to the noncore system; and

(6) electrical power transmission and distribution facilities necessary for services to core system facilities.

(e) AUTHORITY TO ACQUIRE PROPERTY.—Where, in carrying out the provisions of this title for construction of the core system, it becomes necessary to acquire any rights or property, the Authority, acting pursuant to State law, Mont. Code Ann. Sec. 75–6–313 (2001), is hereby authorized to acquire the same by condemnation under judicial process, and to pay such sums which may be needed for that purpose. Nothing in this section shall apply to land held in trust by the United States.

(f) ON-RESERVATION WATER DISTRIBUTION SYSTEMS.—

(1) IN GENERAL.—The Secretary is authorized to operate, maintain, and replace the water distribution systems of the Reservation.

(2) OPERATION, MAINTENANCE, AND REPLACEMENT.—The cost of operation, maintenance, and replacement of the on-reservation water distribution systems shall be allocated as follows: Up to 100 percent of the Tribe's share of the OM&R costs, as negotiated in the Agreements, shall be funded through the Chippewa Cree Water System Operation, Maintenance, and Replacement Trust Fund established in section 913.

(3) AGREEMENTS.—Federal funds made available to carry out this subsection may be obligated and expended only in accordance with the Agreements entered into under subsection (g).

(4) COMPONENTS.—As described in the final engineering report, the on-reservation water distribution systems shall consist of—

(A) water systems in existence on the date of enactment of this title that may be purchased, improved, and repaired in accordance with the Agreements entered into under subsection (g);

(B) water systems owned by individual members of the Tribe and other residents of the Reservation;

(C) any water distribution system that is upgraded to current standards, disconnected from low-quality wells; and

(D) connections.

(5) CONSTRUCTION OF NEW FACILITIES, OR EXPANSION OR REHABILITATION OF CURRENT FACILITIES.—The Tribe shall use $10,000,000 of the $15,000,000 appropriated pursuant to the Chippewa Cree Tribe of the Rocky Boy's Reservation Indian Reserved Water Rights Settlement and Water Supply Enhancement Act of 1999 (Public Law 106–163), plus accrued interest, in the purchase, construction, expansion, or rehabilitation of the on-reservation water distribution systems.

(g) AGREEMENTS.—Federal funds made available to carry out subsections (b), (c), and (f) may be obligated and expended only in accordance with the agreements entered into under this subsection.

(1) IN GENERAL.—At the request of the Tribe, the Secretary shall enter into self-governance agreements under title IV of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 458aa et seq.) with the Tribe, in accordance with this title—

(A) through the Bureau of Reclamation, to plan, design, and construct the core system; and

(B) through the Bureau of Indian Affairs, to operate, maintain, and replace the core system and the on-Reservation water distribution systems.

(2) PROJECT OVERSIGHT ADMINISTRATION.—The amount of Federal funds that may be used to provide technical assistance and conduct the necessary construction oversight, inspection, and administration of activities in paragraph (1)(A) shall be negotiated with the Tribe and shall be an allowable project cost.

(h) SERVICE AREA.—The service area of the Rocky Boy's Rural Water System shall be the core system and the Reservation.

(i) TITLE TO CORE SYSTEM.—Title to the core system—

(1) shall be held in trust by the United States for the Tribe; and

(2) shall not be transferred unless a transfer is authorized by an Act of Congress enacted after the date of enactment of this title.

(j) TECHNICAL ASSISTANCE.—The Secretary is authorized to provide such technical assistance as is necessary to enable the Tribe to—

(1) plan, design, and construct the core system, including management training. Such technical assistance shall be deemed as a core system project construction cost; and

(2) operate, maintain, and replace the core system and the on-reservation water distribution systems. Such technical assistance shall be deemed as a core system and an on-reservation water distribution systems operation, maintenance, and replacement cost, as appropriate.

SEC. 905. NONCORE SYSTEM.

(a) IN GENERAL.—The Secretary is authorized to enter into Cooperative Agreements with the Authority to provide Federal funds for the planning, design, and construction of the noncore system in Chouteau, Glacier, Hill, Liberty, Pondera, Teton, and Toole Counties, Montana, outside the Reservation.

(b) FEDERAL SHARE.—

(1) PLANNING, DESIGN, AND CONSTRUCTION.—The Federal share of the cost of planning, design, and construction of the noncore system shall be 80 percent and will be funded through annual appropriations to the Bureau of Reclamation.

(2) OPERATION, MAINTENANCE, AND REPLACEMENT OF NONCORE SYSTEM COMPONENTS.—The cost of operation, maintenance, and replacement associated with water deliveries to the noncore system shall not be a Federal responsibility and shall be borne by the Authority.

(3) COOPERATIVE AGREEMENTS.—Federal funds made available to carry out this section may be obligated and expended only in accordance with the Cooperative Agreements entered into under subsection (d).

(c) COMPONENTS.—As described in the final engineering report, the components of the noncore system on which Federal funds may be obligated and expended under this section shall include—

(1) storage, pumping, and pipeline facilities;

(2) appurtenant buildings, maintenance equipment, and access roads;

(3) all property and property rights necessary for the facilities described in this subsection;

(4) electrical power transmission and distribution facilities necessary for service to noncore system facilities; and

(5) other facilities and services customary to the development of a rural water distribution system in the State.

(d) COOPERATIVE AGREEMENTS.—

(1) IN GENERAL.—The Secretary is authorized to enter into the Cooperative Agreements with the Authority to provide Federal funds and necessary assistance for the planning, design, and construction of the noncore system. The Secretary is further authorized to enter into a tri-partite Cooperative Agreement with the Authority and the Tribe addressing the allocation of operation, maintenance and replacement costs for the core system and action that can be undertaken to keep those costs within reasonable levels.

(2) MANDATORY PROVISIONS.—The Cooperative Agreements under paragraph (1) shall specify, in a manner that is acceptable to the Secretary and the Authority—

(A) the responsibilities of each party to the agreements for—

(i) the final engineering report;

(ii) engineering and design;

(iii) construction;

(iv) water conservation measures;

(v) environmental and cultural resource compliance activities; and

(vi) administration of contracts relating to performance of the activities described in clauses (i) through (v);

(B) the procedures and requirements for approval and acceptance of the design and construction and for carrying out other activities described in subparagraph (A); and

(C) the rights, responsibilities, and liabilities of each party to the agreements.

(3) PROJECT OVERSIGHT ADMINISTRATION.—The amount of Federal funds that may be used to provide technical assistance and to conduct the necessary construction oversight, inspection, and administration of activities in paragraph (1) shall be negotiated with the Authority, and shall be an allowable project cost.

(e) SERVICE AREA.—

(1) IN GENERAL.—Except as provided in paragraph (2), the service area of the noncore system shall be generally defined as the area—

(A) north of the Missouri River and Dutton, Montana;

(B) south of the border between the United States and Canada;

(C) west of Havre, Montana;

(D) east of Cut Bank Creek in Glacier County, Montana; and

(E) as further defined in the final engineering report, referenced in section 904(a).

(2) EXCLUSIONS FROM SERVICE AREA.—The service area of the noncore system shall not include the area inside the Reservation.

(f) LIMITATION ON USE OF FEDERAL FUNDS.—The operation, maintenance, and replacement expenses for the noncore system—

(1) shall not be a Federal responsibility;

(2) shall be borne by the Authority; and

(3) the Secretary may not obligate or expend any Federal funds for the OM&R of the noncore system.

(g) TITLE TO NONCORE SYSTEM.—Title to the noncore system shall be held by the Authority.

(h) AUTHORITY TO ACQUIRE PROPERTY.—Where, in carrying out the provisions of this title for construction of the noncore system, it becomes necessary to acquire any rights or property, the Authority, acting pursuant to State law, Mont. Code Ann. Sec. 75–6–313 (2001), is hereby authorized to acquire the same by condemnation under judicial process, and to pay such sums which may be needed for that purpose. Nothing in this section shall apply to land held in trust by the United States.

SEC. 906. LIMITATION ON AVAILABILITY OF CONSTRUCTION FUNDS.

The Secretary shall not obligate funds for construction of the core system or the noncore system until—

(1) the requirements of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) are met with respect to the core system and the noncore system;

(2) the date that is 90 days after the date of submission to Congress of a final engineering report approved and transmitted by the Secretary; and Deadline. Reports.

(3) the Secretary publishes a written finding that the water conservation plan developed under section 911(a) includes prudent and reasonable water conservation measures for the operation of the Rocky Boy's/North Central Montana Regional Water Publication.

System that have been shown to be economically and financially feasible.

SEC. 907. CONNECTION CHARGES.

The cost of connection of nontribal community water distribution systems and individual service systems to transmission lines of the core system and noncore system shall be the responsibility of the entities receiving water from the transmission lines.

SEC. 908. AUTHORIZATION OF CONTRACTS.

The Secretary is authorized to enter into contracts with the Authority for water from Lake Elwell providing for the repayment of its respective share of the construction, operation, maintenance and replacement costs of Tiber dam and reservoir, as determined by the Secretary, in accordance with Federal Reclamation Law (Act of June 17, 1902, 32 Stat. 388, and Acts amendatory thereof and supplemental thereto).

SEC. 909. TIBER RESERVOIR ALLOCATION TO THE TRIBE.

(a) NO DIMINISHMENT OF STORAGE.—In providing for the delivery of water to the noncore system, the Secretary shall not diminish the 10,000 acre-feet per year of water stored for the Tribe pursuant to section 201 of the Chippewa Cree Tribe of The Rocky Boy's Reservation Indian Reserved Water Rights Settlement and Water Supply Enhancement Act of 1999 (Public Law 106–163) in Lake Elwell, Lower Marias Unit, Upper Missouri Division, Pick-Sloan Missouri Basin Program, Montana.

(b) DRAW OF SUPPLY; PURCHASE OF ADDITIONAL WATER.—In providing for delivery of water to Rocky Boy's Indian Reservation for the purposes of this title, the Tribe shall draw its supply from the 10,000 acre-feet per year of water stored for the Tribe pursuant to section 201 of the Chippewa Cree Tribe of The Rocky Boy's Reservation Indian Reserved Water Rights Settlement and Water Supply Act of 1999 (Public Law 106–163) in Lake Elwell, Lower Marias Unit, Upper Missouri Division, Pick-Sloan Missouri Basin Program, Montana. Nothing in this title shall prevent the Tribe from entering into contracts with the Secretary for the purchase of additional water from Lake Elwell.

SEC. 910. USE OF PICK-SLOAN POWER.

The Secretary of the Interior, in cooperation with the Secretary of Energy, is directed to make Pick-Sloan Missouri Basin Program preference power available, for the purposes of this title. Power shall be made available when pumps are energized and/or upon completion of the Project.

SEC. 911. WATER CONSERVATION PLAN.

(a) IN GENERAL.—The Tribe and the Authority shall develop and incorporate into the final engineering report a water conservation plan that contains—

(1) a description of water conservation objectives;

(2) a description of appropriate water conservation measures; and

(3) a time schedule for implementing the water conservation measures to meet the water conservation objectives.

(b) PURPOSE.—The water conservation plan under subsection (a) shall be designed to ensure that users of water from the core system, on-reservation water distribution systems, and the noncore system will use the best practicable technology and management techniques to conserve water.

Applicability.

(c) COORDINATION OF PROGRAMS.—Section 210 (a) and (c) of the Reclamation Reform Act of 1982 (43 U.S.C. 390jj (a) and (c)) shall apply to activities under section 911 of this title.

SEC. 912. WATER RIGHTS.

This title does not—

(1) impair the validity of or preempt any provision of State water law or any interstate compact governing water;

(2) alter the right of any State to any appropriated share of the water of any body of surface or ground water, whether determined by any past or future interstate compact or by any past or future legislative or final judicial allocation;

(3) preempt or modify any Federal or State law or interstate compact concerning water quality or disposal;

(4) confer on any non-Federal entity the authority to exercise any Federal right to the water of any stream or to any ground water resource; or

(5) affect any right of the Tribe to water, located within or outside the external boundaries of the Reservation, based on a treaty, compact, Executive Order, Agreements, Act of Congress, aboriginal title, the decision in Winters v. United States, 207 U.S. 564 (1908) (commonly known as the "Winters Doctrine"), or other law.

SEC. 913. CHIPPEWA CREE WATER SYSTEM OPERATION, MAINTENANCE, AND REPLACEMENT TRUST FUND.

(a) ESTABLISHMENT OF TRUST FUND.—There is established in the Treasury of the United States a trust fund to be known as the "Chippewa Cree Water System Operation, Maintenance, and Replacement Trust Fund", to be managed and invested by the Secretary.

(b) CONTENTS OF FUND.—The Fund shall consist of—

(1) the amount of $15,000,000 as the Federal share, as authorized to be appropriated in section 914(c);

(2) the Tribe shall deposit into the Fund $5,000,000 of the $15,000,000 appropriated pursuant to the Chippewa Cree Tribe of the Rocky Boy's Reservation Indian Reserved Water Rights Settlement and Water Supply Enhancement Act of 1999 (Public Law 106–163); and

(3) such interest as may accrue, until expended according to subsections (d) and (f).

(c) MANAGEMENT OF THE FUND.—The Secretary shall manage the Fund, make investments from the Fund, and make monies available from the Fund for distribution to the Tribe consistent with the American Indian Trust Fund Management Reform Act of 1994 (25 U.S.C. 4001 et seq.) (referred to in this section as the "Trust Fund Reform Act"), and this title.

(d) USE OF FUND.—The Tribe shall use accrued interest, only, from the Fund for operation, maintenance, and replacement of the core system and the on-reservation distribution, only, pursuant to an operation, maintenance and replacement plan approved by the Secretary.

(e) INVESTMENT OF FUND.—The Secretary shall, after consulting with the Tribe on the investment of the Fund, invest amounts in the Fund in accordance with—

(1) the Act of April 1, 1880 (21 Stat. 70, chapter 41; 25 U.S.C. 161);

(2) the first section of the Act of February 12, 1929 (25 U.S.C. 161a);

(3) the first section of the Act of June 24, 1938 (25 U.S.C. 162a); and

(4) subsection (b).

(f) EXPENDITURES AND WITHDRAWAL.—

(1) TRIBAL MANAGEMENT PLAN.—

(A) WITHDRAWAL BY TRIBE.—The Tribe may withdraw all or part of the Fund on approval by the Secretary of a tribal management plan as described in the Trust Fund Reform Act.

(B) REQUIREMENTS.—In addition to the requirements under the Trust Fund Reform Act, the tribal management plan shall require that the Tribe spend any funds only in accordance with the purposes described in subsections 913 (d) and (f).

(2) ENFORCEMENT.—The Secretary may take judicial or administrative action to enforce the provisions of any tribal management plan to ensure that any monies withdrawn from the Fund under the plan are used in accordance with this title.

(3) LIABILITY.—If the Tribe exercises the right to withdraw monies from the Fund pursuant to the Trust Fund Reform Act, neither the Secretary nor the Secretary of the Treasury shall retain any liability for the expenditure or investment of the monies withdrawn.

(4) OPERATION, MAINTENANCE, AND REPLACEMENT PLAN.—Expenditures of accrued interest, only, from the Fund may be made for operation, maintenance, and replacement plan approved by the Secretary.

(A) IN GENERAL.—The Tribe shall submit to the Secretary for approval an operation, maintenance, and replacement plan for any funds made available to it under this section.

(B) DESCRIPTION.—The plan shall describe the manner in which, and the purposes for which, funds made available to the Tribe will be used.

(C) APPROVAL.—On receipt of an expenditure plan under subparagraph (A), the Secretary shall, in a timely manner, approve the plan if the Secretary determines that the plan is reasonable and consistent with this title.

(5) AVAILABILITY.—Funds made available from the fund under this section shall be available without fiscal year limitation.

(6) ANNUAL REPORT.—The Tribe shall submit to the Secretary an annual report that describes all expenditures from the Fund during the year covered by the report.

(g) NO PER CAPITA DISTRIBUTIONS.—No part of the Fund shall be distributed on a per capita basis to members of the Tribe.

SEC. 914. AUTHORIZATION OF APPROPRIATIONS.

(a) CORE SYSTEM.—There is authorized to be appropriated $129,280,000 to the Bureau of Reclamation for the planning, design, and construction of the core system. The Tribal portion of the costs shall be 76 percent. The Authority's portion of the costs shall be 24 percent.

(b) ON-RESERVATION WATER DISTRIBUTION SYSTEMS.—The Tribe shall use $10,000,000 of the $15,000,000 appropriated pursuant to the Chippewa Cree Tribe of the Rocky Boy's Reservation Indian Reserved Water Rights Settlement and Water Supply Enhancement Act of 1999 (Public Law 106–163), plus accrued interest, in the purchase, construction, expansion or rehabilitation of the on-reservation water distribution systems.

(c) CHIPPEWA CREE WATER SYSTEM OPERATION, MAINTENANCE, AND REPLACEMENT TRUST FUND.—For the Federal contribution to the Fund, established in section 913, there is authorized to be appropriated to the Bureau of Indian Affairs the sum of $7,500,000 each year for fiscal year 2005 and 2006.

(d) NONCORE SYSTEM.—There is authorized to be appropriated $73,600,000 to the Bureau of Reclamation for the planning, design, and construction of the noncore system.

(e) COST INDEXING.—The sums authorized to be appropriated under this section may be increased or decreased by such amounts as are justified by reason of ordinary fluctuations in development costs incurred after the date of enactment of this title, as indicated by engineering cost indices applicable for the type of construction involved.

APPENDIX B

WATER CONSERVATION PLAN

(BOUND SEPARATELY)

APPENDIX C

RAW WATER DATA

Date	Station Location	Barometric Pressure mmHg	Depth meters	Dissolved Oxygen mg/L	Temp Celcius	pH	Turbidity NTU	Total Dissolved Solids mg/L
5/1/2002	T1	692.3	1.2	9.34	9.65	8.34		0.2598
5/1/2002	T1	692.2	1.2	9.34	9.53	8.34		0.2599
5/1/2002	T2	690.6	0.6	7.36	9.67	8.26	55.7	0.2905
5/1/2002	T2	690.6	2	7.28	9.44	8.34	38.1	0.29
5/1/2002	T2	690.7	4	6.4	9.5	8.38	29	0.2953
5/1/2002	T2	690.6	5.9	6.16	9.51	8.4	46.6	0.3034
5/1/2002	T2	690.7	8	5.8	9.6	8.44	27.6	0.3226
5/1/2002	T2	690.6	10.3	5.71	9.64	8.45	19.7	0.3292
5/1/2002	T2	690.3	13.1	5.64	9.77	8.45	18.9	0.3303
5/1/2002	T2	690.3	14.1	5.64	9.65	8.43	296.1	0.3308
5/1/2002	T3	690.5	0.8	5.69	10.45	8.63		0.3447
5/1/2002	T3	689.2	3	5.66	10.29	8.55	1.1	0.3453
5/1/2002	T3	690.6	5.8	5.4	10.24	8.52	2.2	0.3453
5/1/2002	T3	690.5	9	5.18	10.17	8.51	2.4	0.3448
5/1/2002	T3	690.3	12.2	5.06	10.16	8.51	2.2	0.3442
5/1/2002	T3	690.2	16.2	5.01	10.19	8.5	2.5	0.3442
5/1/2002	T3	690.5	19.9	4.98	10.07	8.5	2.7	0.3441
5/1/2002	T3	690.3	23	4.97	10.06	8.49	2.7	0.3443
5/1/2002	T3	690.2	23.1	4.97	10.03	8.49	2.6	0.344
5/1/2002	T3	689.4	26.7	4.95	10.1	8.51	90.9	0.3441
5/1/2002	T4	690.4	0.6	6.79	10.25	8.64	483.4	0.3383
5/1/2002	T4	690.5	3.1	6.72	10	8.61	4	0.3385
5/1/2002	T4	689.4	5.1	5.82	9.96	8.56	4.1	0.3385
5/1/2002	T4	690.5	7	5.56	10.02	8.54	4.4	0.3393
5/1/2002	T4	690.5	10.1	5.51	9.97	8.54	3.6	0.3393
5/1/2002	T4	690.7	12.6	5.37	9.9	8.52	13.6	0.3404
5/1/2002	T5	690.3	0.4	5.37	10.37	8.51		0.345
5/1/2002	T5	690.3	3	5.19	10.28	8.56	1.2	0.3461
5/1/2002	T5	690.3	7	4.68	10.33	8.52	1.5	0.3462
5/1/2002	T5	690.5	10	4.68	10.28	8.51	1	0.3461
5/1/2002	T5	690.5	13.9	4.57	10.31	8.5	1.3	0.346
5/1/2002	T5	690.5	18	4.52	10.28	8.5	1.7	0.345
5/1/2002	T5	690.5	24.2	4.48	10.23	8.5	1.3	0.3453
5/1/2002	T5	690.4	29.1	4.43	10.21	8.5	1.5	0.346
5/1/2002	T5	690.4	34.2	4.38	10.17	8.5	2.7	0.3468
5/1/2002	T5	690.3	39.1	4.32	10.18	8.49	2.7	0.3453
5/1/2002	T5	690.5	40.9	4.32	10.1	8.47	335.5	0.3461

Date	Station Location	Barometric Pressure mmHg	Depth meters	Dissolved Oxygen mg/L	Temp Celcius	pH	Turbidity NTU	Total Dissolved Solids mg/L
6/12/2002	T5	695.6	0.5	11.3	8.6	8.29	1.4	0.3231
6/12/2002	T5	695.7	2	11.28	8.46	8.3	9.1	0.3229
6/12/2002	T5	695.3	2.9	11.24	8.41	8.3	9.4	0.3229
6/12/2002	T5	695.4	5	11.25	8.28	8.31	5.7	0.3231
6/12/2002	T5	695.4	6.8	11.15	8.28	8.3	5.9	0.3238
6/12/2002	T5	695.4	8.9	11.14	8.3	8.3	2.8	0.3238
6/12/2002	T5	695.4	11.1	11.12	8.32	8.3	9.6	0.3244
6/12/2002	T5	695.1	13	11.1	8.27	8.31	9.4	0.324
6/12/2002	T5	695.3	14.9	11.09	8.25	8.31	9.3	0.3236
6/12/2002	T5	695.2	17	11.09	8.24	8.3	3.4	0.3242
6/12/2002	T5	695.4	19.1	11.07	8.31	8.29	3.9	0.3238
6/12/2002	T5	695.1	22	11.05	8.25	8.3	10.1	0.324
6/12/2002	T5	695.3	26.3	11.05	8.18	8.29	9.1	0.3245
6/12/2002	T5	695.1	26.9	11.02	8.2	8.29	5.1	0.3246
6/12/2002	T5	695	30	10.97	8.27	8.3	3.3	0.3254
6/12/2002	T5	695.2	33.7	10.31	8.36	8.28	2.8	0.3287
6/12/2002	T5	695.4	36.4	8.58	8.51	8.23		0.3383
6/12/2002	T5	695.2	40.2	7.7	8.65	8.21		0.3433
6/12/2002	T5	695.2	44.9	7.36	8.39	8.15		0.3442
6/12/2002	T4	695.2	0.5	10.42	8.89	8.46	4.1	0.3274
6/12/2002	T4	695.6	1.9	10.41	8.66	8.46	4.9	0.3272
6/12/2002	T4	695.6	2.9	10.31	8.57	8.41	5.4	0.328
6/12/2002	T4	695.3	4.2	10.27	8.53	8.38	4.7	0.3275
6/12/2002	T4	695.4	5.9	10.27	8.5	8.36	4.7	0.3279
6/12/2002	T4	695.5	7.1	10.22	8.46	8.33	5.2	0.3276
6/12/2002	T4	695.5	8.3	10.22	8.39	8.32	6	0.3283
6/12/2002	T4	695.2	10	10.08	8.4	8.3	6	0.3281
6/12/2002	T4	695.5	11	10.06	8.32	8.29	5.2	0.3284
6/12/2002	T4	695.5	12.7	10.04	8.31	8.29	6.8	0.3285
6/12/2002	T4	695.4	12.7	10.02	8.33	8.29	6.2	0.3288
6/12/2002	T4	695.6	14.6	10	8.36	8.27	6.8	0.3287
6/12/2002	T4	695.3	15.5	9.99	8.32	8.28	7.7	0.3285
6/12/2002	T4	694.7	16.5	9.98	8.2	8.27	74.6	0.329
6/12/2002	T3	695.4	0.4	10.81	8.82	8.34	205.4	0.308
6/12/2002	T3	695.4	2	10.83	8.54	8.35	17.7	0.3083
6/12/2002	T3	695.6	4.1	10.72	8.47	8.32	18.8	0.3058
6/12/2002	T3	695.6	5.9	10.71	8.39	8.29	17.6	0.3059
6/12/2002	T3	695.6	7.8	10.59	8.39	8.27	20.6	0.3033
6/12/2002	T3	695.4	10	10.43	8.32	8.26	23.1	0.3011
6/12/2002	T3	695.3	12.8	10.43	8.39	8.26	23.7	0.3007
6/12/2002	T3	695.6	15	10.45	8.3	8.28	24.8	0.3005
6/12/2002	T3	695.6	17.3	10.43	8.36	8.26	21.7	0.3022
6/12/2002	T3	695.4	20.3	10.43	8.28	8.28	25.6	0.3019
6/12/2002	T3	695.6	22.9	10.43	8.23	8.26	24.3	0.3029
6/12/2002	T3	695.6	24.7	9.97	8.32	8.28	7.9	0.324
6/12/2002	T3	695.5	27.5	9.53	8.39	8.27	5.6	0.3306
6/12/2002	T3	695.5	30.2	8.92	8.41	8.25	3.1	0.3341
6/12/2002	T3	695.4	31.7	8.7	8.35	8.23	83.8	0.3356

Date	Station Location	Barometric Pressure mmHg	Depth meters	Dissolved Oxygen mg/L	Temp Celcius	pH	Turbidity NTU	Total Dissolved Solids mg/L
6/12/2002	T2	696.2	0.4	10.61	8.77	8.35	118.2	0.2527
6/12/2002	T2	696.1	2	10.58	8.51	8.35	91.8	0.2505
6/12/2002	T2	696.1	4	10.58	8.45	8.29	84	0.2507
6/12/2002	T2	695	6.1	10.56	8.37	8.26	87.9	0.2509
6/12/2002	T2	696.2	8	10.43	8.34	8.23	83.4	0.2534
6/12/2002	T2	696.1	10.4	8.27	8.5	7.93	139.6	0.3048
6/12/2002	T2	696.1	12	7.34	8.53	7.83	170.5	0.3259
6/12/2002	T2	696	14	6.06	8.54	7.72	240.4	0.3691
6/12/2002	T2	696	16.1	6.03	8.47	7.7	248.2	0.3753
6/12/2002	T2	696.4	18	5.92	8.44	7.69	289.1	0.3845
6/12/2002	T2	696	18.1	5.91	8.36	7.69	276.5	0.3841
6/12/2002	T1	695.8	0.4	5.84	9.68	8.05	785.9	0.3103
6/12/2002	T1	696	1.3	5.79	9.44	8.09	809.5	0.311
6/12/2002	T1	696.1	2	5.75	9.36	8.04	918.6	0.3113
6/12/2002	T1	695.9	3	5.71	9.31	8	997	0.312
6/12/2002	T1	695.8	4.2	5.49	9.24	7.96	1000#	0.3114
6/12/2002	T1	695.9	5.8	5.39	9.16	7.95	1000#	0.3118
8/14/2002	T5	685.5	1	19.92	7.77	8.4		0.3293
8/14/2002	T5	685.7	3.1	19.76	7.65	8.43		0.3307
8/14/2002	T5	685.5	5	19.17	7.54	8.43		0.3306
8/14/2002	T5	685.6	6.1	18.91	7.47	8.42		0.3315
8/14/2002	T5	685.6	7	18.8	7.47	8.42		0.3323
8/14/2002	T5	685.5	7.9	18.75	7.39	8.42		0.3327
8/14/2002	T5	685.4	9	18.68	7.39	8.41		0.3338
8/14/2002	T5	685.5	10	18.61	7.32	8.41		0.3339
8/14/2002	T5	684.6	11	18.5	7.15	8.38		0.3348
8/14/2002	T5	685.2	12.1	18.44	6.95	8.36		0.336
8/14/2002	T5	685.3	13.3	18.34	6.89	8.34		0.3365
8/14/2002	T5	685.6	14.1	18.3	6.81	8.33		0.3372
8/14/2002	T5	685.2	15.2	18.2	6.8	8.32		0.3377
8/14/2002	T5	685.6	17	17.92	6.54	8.25		0.3397
8/14/2002	T5	685.3	18	17.86	6.47	8.24		0.3409
8/14/2002	T5	685.2	19.2	17.45	6.19	8.15		0.3431
8/14/2002	T5	685.1	21	15.19	5.44	7.8		0.3558
8/14/2002	T5	684.7	22.9	13.66	5.53	7.75		0.3671
8/14/2002	T5	684.9	25.1	12.8	5.69	7.75		0.3773
8/14/2002	T5	685.2	27.1	12.39	5.83	7.77		0.3879
8/14/2002	T5	684.9	30.2	11.79	5.98	7.78		0.3956
8/14/2002	T5	685	33.2	11	6.15	7.78		0.3756
8/14/2002	T5	685	36.3	10.51	6.15	7.76		0.3787
8/14/2002	T5	685.1	39.7	10.01	6.15	7.74		0.3823
8/14/2002	T5	685	43.1	9.44	5.92	7.7		0.3885
8/14/2002	T5	684.7	45	8.9	5.49	7.59	12.3	0.3956
8/14/2002	T3	685.3	1	18.52	7.84	8.26		0.3199
8/14/2002	T3	685.1	2.2	18.53	7.74	8.27		0.3206
8/14/2002	T3	685.3	4.1	18.38	7.64	8.26		0.3208
8/14/2002	T3	685.3	6	18.23	7.5	8.26		0.322
8/14/2002	T3	685.2	8	18.17	7.4	8.26		0.3232

Date	Station Location	Barometric Pressure mmHg	Depth meters	Dissolved Oxygen mg/L	Temp Celcius	pH	Turbidity NTU	Total Dissolved Solids mg/L
8/14/2002	T3	685.2	10	18.11	7.36	8.27		0.3239
8/14/2002	T3	685.1	12.2	18.06	7.3	8.26		0.3246
8/14/2002	T3	685.1	14.1	17.99	7.23	8.26		0.3251
8/14/2002	T3	685	16.1	17.5	6.83	8.22		0.3302
8/14/2002	T3	685.2	17.2	16.52	6.26	8		0.3297
8/14/2002	T3	685	18	16.03	5.91	7.91		0.3296
8/14/2002	T3	685.3	19.1	15.46	5.81	7.83		0.3293
8/14/2002	T3	684.9	21	13.77	5.67	7.74		0.3352
8/14/2002	T3	685	23	12.91	5.66	7.69		0.3405
8/14/2002	T3	684.8	24.2	12.41	5.63	7.7		0.3493
8/14/2002	T3	685.1	26.9	11.84	5.68	7.7		0.3552
8/14/2002	T3	685	28.2	11.43	5.7	7.7		0.3606
8/14/2002	T3	685	29	11.13	5.57	7.68		0.3633
8/14/2002	T3	684.9	30.3	10.81	5.41	7.65		0.3663
8/14/2002	T3	685	31	10.76	5.24	7.64	285.4	0.366
8/14/2002	T2	687.7	1	18.15	7.95	8.16		0.3232
8/14/2002	T2	687.6	2	18.16	7.63	8.16		0.3231
8/14/2002	T2	687.7	4	18.17	7.63	8.16		0.3237
8/14/2002	T2	687.6	4.9	18.18	7.54	8.16		0.3239
8/14/2002	T2	687.7	6.8	18.18	7.48	8.17		0.3246
8/14/2002	T2	687.6	9.2	17.63	7.27	8.16		0.3241
8/14/2002	T2	687.6	10	17.63	7.22	8.16		0.3246
8/14/2002	T2	687.6	11	17.66	7.14	8.14		0.3194
8/14/2002	T2	687.6	12.2	17.64	7.14	8.16		0.3196
8/14/2002	T2	687.6	13	17.63	7.14	8.14		0.3196
8/14/2002	T2	688	14.3	17.63	7.16	8.13		0.3194
8/14/2002	T2	687.4	14.4	17.48	7.05	8.11		0.32
8/14/2002	T2	687.6	15.8	16.83	6.58	7.98		0.3218
8/14/2002	T2	687.6	17.6	16.03	5.8	7.78	10	0.3254
8/14/2002	T2	687.6	18.1	16.01	5.56	7.77	10.5	0.327
8/14/2002	T2	687.3	18.3	15.52	5.37	7.7	244.9	0.3285
8/14/2002	T1	689.4	0.9	18.82	7.47	8.25	24.5	0.3918
8/14/2002	T1	689.5	2.1	18.82	7.33	8.25	28.8	0.3924
8/14/2002	T1	689.7	2.6	18.82	7.26	8.25	177.9	0.3928
8/14/2002	T4	690.3	1	18.18	7.69	8.29		0.3205
8/14/2002	T4	690.4	1.8	18.18	7.34	8.29		0.3204
8/14/2002	T4	690.4	3.1	18.17	7.37	8.29		0.3201
8/14/2002	T4	690.3	4	18.17	7.32	8.29		0.3204
8/14/2002	T4	690.5	5.2	18.14	7.31	8.29		0.3205
8/14/2002	T4	690.2	6.1	18.13	7.29	8.28		0.3209
8/14/2002	T4	690.3	7	18.05	7.27	8.28		0.321
8/14/2002	T4	690.2	8	18.07	7.35	8.28		0.3208
8/14/2002	T4	690.2	8.7	18.06	7.31	8.28		0.3219
8/14/2002	T4	690.4	10.8	17.79	6.89	8.24		0.3222
8/14/2002	T4	690.3	11.1	17.47	6.8	8.19		0.3247
8/14/2002	T4	690.4	12.3	17.41	6.66	8.18		0.3248
8/14/2002	T4	690.3	13.5	17.26	6.56	8.14		0.3259
8/14/2002	T4	690.4	15	17.11	6.32	8.12		0.3267
8/14/2002	T4	689.8	15.9	16.96	6.24	8.09		0.327

Date	Station Location	Barometric Pressure mmHg	Depth meters	Dissolved Oxygen mg/L	Temp Celcius	pH	Turbidity NTU	Total Dissolved Solids mg/L
9/16/2002	T5	681.7	0.8	19.1	7.73	8.41	20.3	0.3047
9/16/2002	T5	681.6	2	19.04	7.6	8.42		0.3047
9/16/2002	T5	681.7	4	18.13	7.71	8.43		0.3041
9/16/2002	T5	681.6	5.1	18	7.71	8.43		0.3041
9/16/2002	T5	681.7	6.1	17.92	7.62	8.41		0.3042
9/16/2002	T5	681.8	7	17.83	7.47	8.39		0.3043
9/16/2002	T5	681.6	8	17.76	7.29	8.38		0.3045
9/16/2002	T5	681.8	9	17.72	7.24	8.37		0.3044
9/16/2002	T5	681.3	10.1	17.66	7.09	8.36		0.3044
9/16/2002	T5	681.7	11	17.62	7.01	8.34		0.3046
9/16/2002	T5	681.3	12.2	17.57	6.88	8.33		0.3047
9/16/2002	T5	681.7	14.2	17.49	6.73	8.3		0.3052
9/16/2002	T5	681.5	16	17.33	6.51	8.26		0.3052
9/16/2002	T5	681.6	18.1	16.95	6.18	8.17		0.3054
9/16/2002	T5	681.6	19.2	16.9	6.05	8.15		0.3057
9/16/2002	T5	681.5	20	16.82	6	8.14		0.3058
9/16/2002	T5	681.5	21	16.69	5.91	8.11		0.3059
9/16/2002	T5	681.6	21.9	16.59	5.83	8.08		0.3061
9/16/2002	T5	681.5	24.2	15.83	5.44	7.93		0.3074
9/16/2002	T5	681.5	27	13.81	4.83	7.74		0.3128
9/16/2002	T5	681.6	29.3	12.92	4.85	7.71		0.3153
9/16/2002	T5	681.5	32.9	12.04	4.84	7.69		0.318
9/16/2002	T5	681.5	36.1	11.39	4.74	7.66		0.3213
9/16/2002	T5	681.6	36.1	11.4	4.67	7.66		0.3211
9/16/2002	T5	681.4	39.7	10.56	4.33	7.62		0.3273
9/16/2002	T5	681.4	44.2	9.61	2.8	7.46	18.9	0.3368
9/16/2002	T5	681.5	42.3	10.08	3.76	7.59		0.3317
9/16/2002	T5	681.6	40	10.46	4.01	7.61		0.3283
9/16/2002	T4	682.3	0.9	18.66	7.93	8.39		0.3057
9/16/2002	T4	682.4	1.9	18.48	7.81	8.43		0.3055
9/16/2002	T4	682.4	3.1	18.41	7.8	8.45		0.3057
9/16/2002	T4	682.4	4.3	18.38	7.74	8.45		0.3053
9/16/2002	T4	682.1	6	18.03	7.68	8.41		0.306
9/16/2002	T4	682.4	7	17.81	7.53	8.42		0.3063
9/16/2002	T4	682.4	8	17.72	7.39	8.38		0.3066
9/16/2002	T4	682.3	9.1	17.65	7.19	8.37		0.3066
9/16/2002	T4	682.3	10.1	17.61	7.18	8.36		0.3067
9/16/2002	T4	682.5	10.8	17.56	7.09	8.36		0.3067
9/16/2002	T4	682.4	12	17.48	7.06	8.34		0.3071
9/16/2002	T4	682.5	13.1	17.42	6.96	8.32		0.307
9/16/2002	T4	682.4	14.1	17.38	6.84	8.29		0.3073
9/16/2002	T4	681.9	14.9	17.27	6.77	8.25	165	0.3081
9/16/2002	T3	682.8	0.8	18.35	7.93	8.45		0.3056
9/16/2002	T3	682.7	2.1	18.36	7.92	8.41		0.3056
9/16/2002	T3	682.7	2.9	18.37	7.91	8.44		0.3058
9/16/2002	T3	682.8	4.1	18.26	7.96	8.43		0.3054
9/16/2002	T3	682.8	5.1	18.03	7.86	8.44		0.3059
9/16/2002	T3	682.9	6	17.76	7.67	8.38		0.3055
9/16/2002	T3	683.2	7.1	17.76	7.65	8.38		0.3056

Date	Station Location	Barometric Pressure mmHg	Depth meters	Dissolved Oxygen mg/L	Temp Celcius	pH	Turbidity NTU	Total Dissolved Solids mg/L
9/16/2002	T3	682.8	8.2	17.72	7.47	8.37		0.3056
9/16/2002	T3	682.8	10.3	17.65	7.41	8.36		0.3058
9/16/2002	T3	683.1	11.1	17.59	7.15	8.32		0.306
9/16/2002	T3	682.9	12.1	17.48	6.94	8.26		0.3062
9/16/2002	T3	683.1	13.2	17.41	6.76	8.24		0.306
9/16/2002	T3	682.8	14.1	17.32	6.59	8.19		0.3073
9/16/2002	T3	682.8	15.4	17.29	6.41	8.18		0.3073
9/16/2002	T3	683	18	17.13	6.37	8.16		0.3105
9/16/2002	T3	682.7	20.2	16.94	6.05	8.08		0.3138
9/16/2002	T3	682.8	20.2	16.92	6.06	8.07		0.3143
9/16/2002	T3	682.8	22.4	16.57	5.64	7.98		0.31
9/16/2002	T3	682.9	24.2	14.93	4.69	7.73		0.3083
9/16/2002	T3	682.7	26.2	13.78	4.36	7.67		0.3105
9/16/2002	T3	682.7	26.2	13.78	4.27	7.67		0.3107
9/16/2002	T3	682.9	28.2	12.93	4.27	7.65		0.3138
9/16/2002	T3	682.3	29.8	12.52	4	7.61		0.3168
9/16/2002	T2	683.5	0.9	18.13	7.89	8.36		0.311
9/16/2002	T2	683.2	1.9	18.12	7.82	8.35		0.3112
9/16/2002	T2	683.4	2.9	18.12	7.78	8.37		0.3111
9/16/2002	T2	683.4	3.7	18.12	7.84	8.38		0.3113
9/16/2002	T2	683.6	5	18.11	7.81	8.38		0.3111
9/16/2002	T2	683.5	6	18.08	7.69	8.37		0.3111
9/16/2002	T2	683.3	8.1	18.1	7.67	8.38		0.3112
9/16/2002	T2	683.4	8.8	17.97	7.69	8.35		0.3111
9/16/2002	T2	683.5	10	17.66	7.45	8.29		0.3117
9/16/2002	T2	683.6	10.9	17.57	7.1	8.25		0.3144
9/16/2002	T2	682.8	11.7	17.55	6.9	8.24		0.3156
9/16/2002	T2	683.5	13.6	17.29	6.87	8.16		0.32
9/16/2002	T2	683.5	14.1	17.24	6.71	8.16		0.325
9/16/2002	T2	683.4	15.3	17.23	6.62	8.17		0.3326
9/16/2002	T2	683.5	16.2	17.21	6.67	8.15		0.3712
9/16/2002	T2	683.6	17.4	16.93	6.26	7.98	119.1	0.4433
9/16/2002	T2	683.5	17.4	16.88	5.94	7.96		0.474
9/16/2002	T1	684.1	0.9	18.24	7.99	8.46	18.3	0.574
9/16/2002	T1	684.1	1.8	18.23	7.84	8.46	17.8	0.574
9/16/2002	T1	684.1	2.3	18.21	7.83	8.44	18.5	0.574

Date	Station Location	Barometric Pressure mmHg	Depth meters	Dissolved Oxygen mg/L	Temp Celcius	pH	Turbidity NTU	Total Dissolved Solids mg/L
10/9/2002	T5	8	480.3	692.9	98	0.5	8.23	0.5
10/9/2002	T5	8	480.4	692.9	95	1.5	8.23	0
10/9/2002	T5	8	480.8	692.7	100.3	3	8.23	0
10/9/2002	T5	8	480.9	692.7	96.7	5.1	8.24	0
10/9/2002	T5	8	481.3	692.7	95.3	6.9	8.24	0
10/9/2002	T5	8	480.9	692.4	96.9	7.9	8.24	0
10/9/2002	T5	7.9	481.4	692.4	94.4	8	8.24	0
10/9/2002	T5	7.9	481.4	692.4	93.6	9.9	8.24	0
10/9/2002	T5	7.9	481.6	692.4	93.7	12.1	8.23	0
10/9/2002	T5	7.9	481.8	692.5	93.3	14.1	8.24	0
10/9/2002	T5	7.9	481.7	692.5	93.9	16.1	8.24	0
10/9/2002	T5	7.9	482	692.4	93.5	19	8.23	0
10/9/2002	T5	7.9	481.8	692.4	92.9	22.1	8.24	0
10/9/2002	T5	7.9	482.3	692.5	92.2	24.1	8.23	0
10/9/2002	T5	7.9	482.4	692.5	92.6	26	8.23	0
10/9/2002	T5	7.9	482.8	692.4	91.4	28.3	8.22	0
10/9/2002	T5	7.9	483.5	692.4	91.4	31	8.2	0
10/9/2002	T5	7.9	483.9	692.3	88.6	33	8.18	0
10/9/2002	T5	7.9	488	692.3	82.5	36	8.05	0
10/9/2002	T5	7.9	495.7	692.2	68.3	38.4	7.82	0
10/9/2002	T5	7.9	514.1	692.2	50.7	40.9	7.54	0
10/9/2002	T5	7.9	477.3	692.3	38.4	42.9	7.45	135.7
10/9/2002	T4	7.9	450.5	689.4	102.6	0.6	8.32	0
10/9/2002	T4	7.9	449.9	689.7	101.8	1	8.29	0
10/9/2002	T4	7.9	451.6	689.6	100.5	2	8.29	0
10/9/2002	T4	7.9	450.3	689.6	99.9	3	8.29	0
10/9/2002	T4	7.9	451.2	689.2	99.2	4.1	8.29	0
10/9/2002	T4	7.9	449.9	689.4	98.5	5.2	8.29	0
10/9/2002	T4	7.9	450.7	689.5	98	6	8.29	0
10/9/2002	T4	7.9	449.9	689.4	100.6	6.9	8.29	0
10/9/2002	T4	7.9	451	689.5	100.5	8.1	8.3	0
10/9/2002	T4	7.9	450.2	689.4	99.1	9.3	8.29	0
10/9/2002	T4	7.9	448.9	689.4	98.3	10	8.3	0
10/9/2002	T4	7.9	449.3	689.5	100.4	11	8.3	0
10/9/2002	T4	7.9	448.4	689.2	101.9	12	8.3	0
10/9/2002	T4	7.9	448.7	689.4	99.5	13	8.3	0
10/9/2002	T4	7.9	448.1	689.5	101.8	14	8.31	0
10/9/2002	T4	7.9	448.1	689.4	103.6	14.9	8.32	0
10/9/2002	T3	7.9	456.6	688.5	100.3	0.5	8.27	68.3
10/9/2002	T3	7.9	457.1	688.8	101.2	1	8.21	0.8
10/9/2002	T3	7.9	457	688.6	96.8	2	8.2	0
10/9/2002	T3	7.9	456.5	688.8	96	2.8	8.22	0
10/9/2002	T3	7.9	456.9	688.9	96.4	4.1	8.24	0
10/9/2002	T3	7.9	455.5	688.7	96	5.1	8.22	0
10/9/2002	T3	7.9	456.3	688.8	94.7	6.3	8.21	0
10/9/2002	T3	7.8	456.6	688.9	96.8	7.3	8.22	0
10/9/2002	T3	7.9	456.1	688.5	95.6	8.3	8.21	0

Date	Station Location	Barometric Pressure mmHg	Depth meters	Dissolved Oxygen mg/L	Temp Celcius	pH	Turbidity NTU	Total Dissolved Solids mg/L
0/9/2002	T3	7.9	456.3	688.6	94.1	10.2	8.22	0
0/9/2002	T3	7.9	454.6	688.9	94.2	12.1	8.22	0
0/9/2002	T3	7.8	454.5	688.6	93.8	14	8.22	0
0/9/2002	T3	7.8	453.6	688.6	94.6	16.2	8.21	0
0/9/2002	T3	7.8	453.5	688.6	93.5	18.2	8.22	0
0/9/2002	T3	7.8	449.7	688.4	93.4	20.2	8.23	0
0/9/2002	T3	7.8	448.3	688.4	94.9	22.2	8.24	0
0/9/2002	T3	7.8	447.6	688.6	93.8	24.6	8.25	0
0/9/2002	T3	7.8	446	688.2	94.4	26	8.26	0
0/9/2002	T3	7.8	444.8	688.4	94	28.1	8.26	0
0/9/2002	T3	7.8	443.6	688.5	94.1	30.2	8.26	0
0/9/2002	T3	7.8	443.1	688.5	93.4	30.8	8.25	127.2
0/9/2002	T2	7.8	486.7	687.1	114.5	0.5	8.27	6.2
0/9/2002	T2	7.9	486.8	686.4	105	1.1	8.26	0
0/9/2002	T2	7.8	486.9	687	104.1	2	8.29	0
0/9/2002	T2	7.8	486.9	687	102.8	3	8.25	0
0/9/2002	T2	7.8	486.6	686.9	104.6	3.9	8.26	0
0/9/2002	T2	7.8	485.9	687	107.7	4.9	8.29	0
0/9/2002	T2	7.8	485.7	686.9	105.5	6.1	8.23	0
0/9/2002	T2	7.8	485.5	686	103.3	8.1	8.23	0
0/9/2002	T2	7.8	486.9	686.9	99.4	10	8.24	0
0/9/2002	T2	7.8	498.7	686.9	101.5	11.7	8.25	0
0/9/2002	T2	7.8	526	686.8	101.7	14.1	8.25	0
0/9/2002	T2	7.8	546.7	686.7	100.2	16.1	8.26	0
0/9/2002	T2	7.8	548.8	686.7	97.6	17.1	8.25	209.9
0/9/2002	T1	7.8	822.4	686.4	128.7	0.7	8.44	36
0/9/2002	T1	7.8	821.3	686.5	129.6	0.7	8.43	24.9
0/9/2002	T1	7.8	822.3	686.5	126.4	0.7	8.44	24.4
0/9/2002	T1	7.8	446.6	690.3	120.6	0.5	8.05	170.5
0/9/2002	T1	7.8	446.6	690.5	120.1	0.5	8.11	178.2
0/9/2002	T1	7.8	446.5	690.5	120.5	0.6	8.1	100.6

APPENDIX D

NATIONAL PRIMARY DRINKING WATER STANDARDS

EPA National Primary Drinking Water Standards

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Acrylamide	TT[8]	Nervous system or blood problems;	Added to water during sewage/wastewater increased risk of cancer treatment	zero
OC	Alachlor	0.002	Eye, liver, kidney or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops	zero
R	Alpha particles	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation	zero
IOC	Antimony	0.006	Increase in blood cholesterol; decrease in blood sugar	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder	0.006
IOC	Arsenic	0.010 as of 1/23/06	Skin damage or problems with circulatory systems, and may have increased risk of getting cancer	Erosion of natural deposits; runoff from orchards, runoff from glass & electronics production wastes	0
IOC	Asbestos (fibers >10 micrometers)	7 million fibers per Liter (MFL)	Increased risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion of natural deposits	7 MFL
OC	Atrazine	0.003	Cardiovascular system or reproductive problems	Runoff from herbicide used on row crops	0.003
IOC	Barium	2	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits	2
OC	Benzene	0.005	Anemia; decrease in blood platelets; increased risk of cancer	Discharge from factories; leaching from gas storage tanks and landfills	zero
OC	Benzo(a)pyrene (PAHs)	0.0002	Reproductive difficulties; increased risk of cancer	Leaching from linings of water storage tanks and distribution lines	zero
IOC	Beryllium	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries	0.004
R	Beta particles and photon emitters	4 millirems per year	Increased risk of cancer	Decay of natural and man-made deposits of certain minerals that are radioactive and may emit forms of radiation known as photons and beta radiation	zero
DBP	Bromate	0.010	Increased risk of cancer	Byproduct of drinking water disinfection	zero
IOC	Cadmium	0.005	Kidney damage	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints	0.005
OC	Carbofuran	0.04	Problems with blood, nervous system, or reproductive system	Leaching of soil fumigant used on rice and alfalfa	0.04
OC	Carbon tetrachloride	0.005	Liver problems; increased risk of cancer	Discharge from chemical plants and other industrial activities	zero
D	Chloramines (as Cl_2)	MRDL=4.0[1]	Eye/nose irritation; stomach discomfort, anemia	Water additive used to control microbes	MRDLG=4[1]

LEGEND

D	Dinsinfectant	IOC	Inorganic Chemical	OC	Organic Chemical
DBP	Disinfection Byproduct	M	Microorganism	R	Radionuclides

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Chlordane	0.002	Liver or nervous system problems; increased risk of cancer	Residue of banned termiticide	zero
D	Chlorine (as Cl_2)	MRDL=4.0[1]	Eye/nose irritation; stomach discomfort	Water additive used to control microbes	MRDLG=4[1]
D	Chlorine dioxide (as ClO_2)	MRDL=0.8[1]	Anemia; infants & young children: nervous system effects	Water additive used to control microbes	MRDLG=0.8[1]
DBP	Chlorite	1.0	Anemia; infants & young children: nervous system effects	Byproduct of drinking water disinfection	0.8
OC	Chlorobenzene	0.1	Liver or kidney problems	Discharge from chemical and agricultural chemical factories	0.1
IOC	Chromium (total)	0.1	Allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits	0.1
IOC	Copper	TT[7]; Action Level = 1.3	Short term exposure: Gastrointestinal distress. Long term exposure: Liver or kidney damage. People with Wilson's Disease should consult their personal doctor if the amount of copper in their water exceeds the action level	Corrosion of household plumbing systems; erosion of natural deposits	1.3
M	*Cryptosporidium*	TT[3]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and fecal animal waste	zero
IOC	Cyanide (as free cyanide)	0.2	Nerve damage or thyroid problems	Discharge from steel/metal factories; discharge from plastic and fertilizer factories	0.2
OC	2,4-D	0.07	Kidney, liver, or adrenal gland problems	Runoff from herbicide used on row crops	0.07
OC	Dalapon	0.2	Minor kidney changes	Runoff from herbicide used on rights of way	0.2
OC	1,2-Dibromo-3-chloropropane (DBCP)	0.0002	Reproductive difficulties; increased risk of cancer	Runoff/leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards	zero
OC	o-Dichlorobenzene	0.6	Liver, kidney, or circulatory system problems	Discharge from industrial chemical factories	0.6
OC	p-Dichlorobenzene	0.075	Anemia; liver, kidney or spleen damage; changes in blood	Discharge from industrial chemical factories	0.075
OC	1,2-Dichloroethane	0.005	Increased risk of cancer	Discharge from industrial chemical factories	zero
OC	1,1-Dichloroethylene	0.007	Liver problems	Discharge from industrial chemical factories	0.007
OC	cis-1,2-Dichloroethylene	0.07	Liver problems	Discharge from industrial chemical factories	0.07
OC	trans-1,2-Dichloroethylene	0.1	Liver problems	Discharge from industrial chemical factories	0.1
OC	Dichloromethane	0.005	Liver problems; increased risk of cancer	Discharge from drug and chemical factories	zero
OC	1,2-Dichloropropane	0.005	Increased risk of cancer	Discharge from industrial chemical factories	zero
OC	Di(2-ethylhexyl) adipate	0.4	Weight loss, live problems, or possible reproductive difficulties	Discharge from chemical factories	0.4
OC	Di(2-ethylhexyl) phthalate	0.006	Reproductive difficulties; liver problems; increased risk of cancer	Discharge from rubber and chemical factories	zero
OC	Dinoseb	0.007	Reproductive difficulties	Runoff from herbicide used on soybeans and vegetables	0.007
OC	Dioxin (2,3,7,8-TCDD)	0.00000003	Reproductive difficulties; increased risk of cancer	Emissions from waste incineration and other combustion; discharge from chemical factories	zero
OC	Diquat	0.02	Cataracts	Runoff from herbicide use	0.02
OC	Endothall	0.1	Stomach and intestinal problems	Runoff from herbicide use	0.1

LEGEND

D	Dinsinfectant
DBP	Disinfection Byproduct
IOC	Inorganic Chemical
M	Microorganism
OC	Organic Chemical
R	Radionuclides

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Endrin	0.002	Liver problems	Residue of banned insecticide	0.002
OC	Epichlorohydrin	TT[8]	Increased cancer risk, and over a long period of time, stomach problems	Discharge from industrial chemical factories; an impurity of some water treatment chemicals	zero
OC	Ethylbenzene	0.7	Liver or kidneys problems	Discharge from petroleum refineries	0.7
OC	Ethylene dibromide	0.00005	Problems with liver, stomach, reproductive system, or kidneys; increased risk of cancer	Discharge from petroleum refineries	zero
IOC	Fluoride	4.0	Bone disease (pain and tenderness of the bones); Children may get mottled teeth	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories	4.0
M	*Giardia lamblia*	TT[3]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	zero
OC	Glyphosate	0.7	Kidney problems; reproductive difficulties	Runoff from herbicide use	0.7
DBP	Haloacetic acids (HAA5)	0.060	Increased risk of cancer	Byproduct of drinking water disinfection	n/a[6]
OC	Heptachlor	0.0004	Liver damage; increased risk of cancer	Residue of banned termiticide	zero
OC	Heptachlor epoxide	0.0002	Liver damage; increased risk of cancer	Breakdown of heptachlor	zero
M	Heterotrophic plate count (HPC)	TT[3]	HPC has no health effects; it is an analytic method used to measure the variety of bacteria that are common in water. The lower the concentration of bacteria in drinking water, the better maintained the water system is.	HPC measures a range of bacteria that are naturally present in the environment	n/a
OC	Hexachlorobenzene	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from metal refineries and agricultural chemical factories	zero
OC	Hexachlorocyclopentadiene	0.05	Kidney or stomach problems	Discharge from chemical factories	0.05
IOC	Lead	TT[7]; Action Level = 0.015	Infants and children: Delays in physical or mental development; children could show slight deficits in attention span and learning abilities; Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits	zero
M	*Legionella*	TT[3]	Legionnaire's Disease, a type of pneumonia	Found naturally in water; multiplies in heating systems	zero
OC	Lindane	0.0002	Liver or kidney problems	Runoff/leaching from insecticide used on cattle, lumber, gardens	0.0002
IOC	Mercury (inorganic)	0.002	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and croplands	0.002
OC	Methoxychlor	0.04	Reproductive difficulties	Runoff/leaching from insecticide used on fruits, vegetables, alfalfa, livestock	0.04
IOC	Nitrate (measured as Nitrogen)	10	Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	10
IOC	Nitrite (measured as Nitrogen)	1	Infants below the age of six months who drink water containing nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	1

LEGEND

D	Disinfectant	**IOC**	Inorganic Chemical	**OC**	Organic Chemical
DBP	Disinfection Byproduct	**M**	Microorganism	**R**	Radionuclides

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Oxamyl (Vydate)	0.2	Slight nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, and tomatoes	0.2
OC	Pentachlorophenol	0.001	Liver or kidney problems, increased cancer risk	Discharge from wood preserving factories	zero
OC	Picloram	0.5	Liver problems	Herbicide runoff	0.5
OC	Polychlorinated biphenyls (PCBs)	0.0005	Skin changes; thymus gland problems; immune deficiencies; reproductive or nervous system difficulties; increased risk of cancer	Runoff from landfills; discharge of waste chemicals	zero
R	Radium 226 and Radium 228 (combined)	5 pCi/L	Increased risk of cancer	Erosion of natural deposits	zero
IOC	Selenium	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems	Discharge from petroleum refineries; erosion of natural deposits; discharge from mines	0.05
OC	Simazine	0.004	Problems with blood	Herbicide runoff	0.004
OC	Styrene	0.1	Liver, kidney, or circulatory system problems	Discharge from rubber and plastic factories; leaching from landfills	0.1
OC	Tetrachloroethylene	0.005	Liver problems; increased risk of cancer	Discharge from factories and dry cleaners	zero
IOC	Thallium	0.002	Hair loss; changes in blood, kidney, intestine, or liver problems	Leaching from ore-processing sites; discharge from electronics, glass, and drug factories	0.0005
OC	Toluene	1	Nervous system, kidney, or liver problems	Discharge from petroleum factories	1
M	Total Coliforms (including fecal coliform and *E. coli*)	5.0%[4]	Not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present[5]	Coliforms are naturally present in the environment as well as feces; fecal coliforms and *E. coli* only come from human and animal fecal waste.	zero
DBP	Total Trihalomethanes (TTHMs)	0.10 0.080 after 12/31/03	Liver, kidney or central nervous system problems; increased risk of cancer	Byproduct of drinking water disinfection	n/a[6]
OC	Toxaphene	0.003	Kidney, liver, or thyroid problems; increased risk of cancer	Runoff/leaching from insecticide used on cotton and cattle	zero
OC	2,4,5-TP (Silvex)	0.05	Liver problems	Residue of banned herbicide	0.05
OC	1,2,4-Trichlorobenzene	0.07	Changes in adrenal glands	Discharge from textile finishing factories	0.07
OC	1,1,1-Trichloroethane	0.2	Liver, nervous system, or circulatory problems	Discharge from metal degreasing sites and other factories	0.20
OC	1,1,2-Trichloroethane	0.005	Liver, kidney, or immune system problems	Discharge from industrial chemical factories	0.003
OC	Trichloroethylene	0.005	Liver problems; increased risk of cancer	Discharge from metal degreasing sites and other factories	zero
M	Turbidity	TT[3]	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (e.g., whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing micro-organisms such as viruses, parasites and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.	Soil runoff	n/a
R	Uranium	30 ug/L as of 12/08/03	Increased risk of cancer, kidney toxicity	Erosion of natural deposits	zero

LEGEND

D	Dinsinfectant	IOC	Inorganic Chemical	OC	Organic Chemical
DBP	Disinfection Byproduct	M	Microorganism	R	Radionuclides

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Vinyl chloride	0.002	Increased risk of cancer	Leaching from PVC pipes; discharge from plastic factories	zero
M	Viruses (enteric)	TT[3]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	zero
OC	Xylenes (total)	10	Nervous system damage	Discharge from petroleum factories; discharge from chemical factories	10

NOTES

1 Definitions

- Maximum Contaminant Level Goal (MCLG)—The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.
- Maximum Contaminant Level (MCL)—The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.
- Maximum Residual Disinfectant Level Goal (MRDLG)—The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
- Maximum Residual Disinfectant Level (MRDL)—The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
- Treatment Technique (TT)—A required process intended to reduce the level of a contaminant in drinking water.

2 Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million (ppm).

3 EPA's surface water treatment rules require systems using surface water or ground water under the direct influence of surface water to (1) disinfect their water, and (2) filter their water or meet criteria for avoiding filtration so that the following contaminants are controlled at the following levels:

- *Cryptosporidium* (as of 1/1/02 for systems serving >10,000 and 1/14/05 for systems serving <10,000) 99% removal.
- *Giardia lamblia* 99.9% removal/inactivation
- Viruses: 99.99% removal/inactivation
- *Legionella*: No limit, but EPA believes that if *Giardia* and viruses are removed/inactivated, *Legionella* will also be controlled.
- Turbidity: At no time can turbidity (cloudiness of water) go above 5 nephelolometric turbidity units (NTU); systems that filter must ensure that the turbidity go no higher than 1 NTU (0.5 NTU for conventional or direct filtration) in at least 95% of the daily samples in any month. As of January 1, 2002, for systems servicing >10,000, and January 14, 2005, for systems servicing <10,000, turbidity may never exceed 1 NTU, and must not exceed 0.3 NTU in 95% of daily samples in any month.
- HPC: No more than 500 bacterial colonies per milliliter
- Long Term 1 Enhanced Surface Water Treatment (Effective Date: January 14, 2005); Surface water systems or (GWUDI) systems serving fewer than 10,000 people must comply with the applicable Long Term 1 Enhanced Surface Water Treatment Rule provisions (e.g. turbidity standards, individual filter monitoring, *Cryptosporidium* removal requirements, updated watershed control requirements for unfiltered systems).
- Filter Backwash Recycling: The Filter Backwash Recycling Rule requires systems that recycle to return specific recycle flows through all processes of the system's existing conventional or direct filtration system or at an alternate location approved by the state.

4 No more than 5.0% samples total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per month.) Every sample that has total coliform must be analyzed for either fecal coliforms or *E. coli* if two consecutive TC-positive samples, and one is also positive for *E. coli* fecal coliforms, system has an acute MCL violation.

5 Fecal coliform and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Disease-causing microbes (pathogens) in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms These pathogens may pose a special health risk for infants, young children, and people with severely compromised immune systems.

6 Although there is no collective MCLG for this contaminant group, there are individual MCLGs for some of the individual contaminants:

- Haloacetic acids: dichloroacetic acid (zero); trichloroacetic acid (0.3 mg/L)
- Trihalomethanes: bromodichloromethane (zero); bromoform (zero), dibromochloromethane (0.06 mg/L)

7 Lead and copper are regulated by a Treatment Technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps For copper, the action level is 1.3 mg/L, and for lead is 0.015 mg/L.

8 Each water system must certify, in writing, to the state (using third-party or manufacturers certification) that when it uses acrylamide and/or epichlorohydrin to treat water, the combination (or product) of dose and monomer level does not exceed the levels specified, as follows: Acrylamide = 0.05% dosed at 1 mg/L (or equivalent); Epichlorohydrin = 0.01% dosed at 20 mg/L (or equivalent).

LEGEND

D	Disinfectant	IOC	Inorganic Chemical	OC	Organic Chemical
DBP	Disinfection Byproduct	M	Microorganism	R	Radionuclides

National Secondary Drinking Water Standards

National Secondary Drinking Water Standards are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply. However, states may choose to adopt them as enforceable standards.

Contaminant	Secondary Standard
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

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APPENDIX E

DETAILED COST ESTIMATE FOR THE WATER TREATMENT PLANT

Site
Latest Revision: May 10, 2004

Raw Water Pipeline	24-inch	5000	LF	72	$/LF	$360,000
Pretreatment to Filter	30-inch	140	LF	100	$/LF	$14,000
Filter to Clearwell	30-inch	250	LF	100	$/LF	$25,000
BW to Filter	24-inch	125	LF	72	$/LF	$9,000
BWD Piping	30-inch	600	LF	90	$/LF	$54,000
FTW Piping	18-inch	600	LF	54	$/LF	$32,400
Sludge Piping	6-inch	1000	LF	18	$/LF	$18,000
BW Recovery FM	12-inch	1000	LF	36	$/LF	$36,000
Pond Recovery FM	6-inch	500	LF	18	$/LF	$9,000
BW Pond Outlet Piping	18-inch	800	LF	54	$/LF	$43,200
Sludge Pond Outlet Piping	8-inch	600	LF	24	$/LF	$14,400
Plant Water	6-inch	1650	LF	18	$/LF	$29,700
Miscellaneous Piping						$84,000
Fire Hydrants		6	EA	2000	$/LF	$12,000
Sewer	8-inch	660	LF	24	$/LF	$15,840
Manholes	4-foot	8	EA	2600	$/EA	$20,800
Septic Tank & Leach Field						$30,000
Chem Piping Banks		660	LF	120	$/LF	$79,200
Clear and Grubbing						$89,250
Storm Drainage						$210,000
Electrical, wire, transf						$714,000
Instrumentation wire						$153,000
Miscellaneous Instrumentation						$150,000
Site Grading						$262,500
Access Road - Gravel						$300,000
Asphalt						$157,500
Curb and Gutter		1260	LF	25	$/LF	$31,500
Sidewalks						$10,500
Landscaping						$126,000
Signs						$10,000
Security						$300,000
Backup Power						$700,000

	$4,101,000
OH & P	$328,000
Subtotal	$4,429,000
Year Adjust	
	1
	1
Subtotal	$ 4,429,000
Location Adjust (Means 1998)	
	1
	1
Total	$ 4,429,000

Intake and Pump Station
Last Revision: May 10, 2004

Components: Two microtunneled intakes, 600 feet long total, 25 foot diameter caission, pump station with 4 vertical turbine pumps

Civil	$339,000
Marine Work	$100,000
Microtunneling	$480,000
Architectural	$267,000
Structural	$814,000
Process	$493,500
Mechanical	$50,000
Elect/Instr.	$603,750
Subtotal	$3,147,250
OH & P	$252,000
Subtotal	$3,399,250
Year Adjust	
ENR 2000	5210
ENR 2003	6733
Subtotal	$4,393,000
Location Adjust (Means 1998)	
Havre	94.4
Denver	93.7
Total	**$4,426,000**

Pretreatment
Last Revision: May 10, 2004

Components: Three options are looked at: conventional, plate settling and Actiflo.
Building was estimated on square footage basis and includes HVAC.

Plate Settling

Civil	$264,000	
Architectural	$622,000	
Structural	$1,107,000	
Process	$1,718,000	
Mechanical	--	
Elect/Instr.	$480,000	
Subtotal	$4,191,000	
OH & P	$335,000	8%
Subtotal	$4,526,000	
Year Adjust		
ENR 2000	6221	
ENR 2003	6733	
Subtotal	$4,898,000	
Location Adjust (Means 1998)		
Havre	94.4	
Billings	96.2	
Total	$4,806,000	

Actiflo

Civil	$153,000	
Architectural	$200,000	
Structural	$534,000	
Process	$1,124,000	
Mechanical	--	
Elect/Instr.	$845,000	
Subtotal	$2,856,000	
OH & P	$228,000	8%
Subtotal	$3,084,000	
Year Adjust		
ENR 2000	6221	
ENR 2003	6733	
Subtotal	$ 3,338,000	
Location Adjust (Means 1998)		
Havre	94.4	
Billings	96.2	
Total	$ 3,276,000	

Conventional

Civil	$556,000
Architectural	$2,108,000
Structural	$2,459,000
Process	$573,000
Mechanical	--
Elect/Instr.	$480,000
Subtotal	$6,176,000
OH & P	$494,000
Subtotal	$6,670,000
Year Adjust	
ENR 2000	6221
ENR 2003	6733
Subtotal	$7,219,000
Location Adjust (Means 199	
Havre	94.4
Billings	96.2
Total	$7,084,000

Filter Building
Last Revision: May 10, 2004

Components: Six single bay filters with 600 sf each, filter to waste, air scour, 20 foot area on the east for piping and blowers, expansion would be to the

Civil	$119,880
Architectural	$603,840
Structural	$569,430
Process	$1,400,760
Mechanical	$214,120
Elect/Instr.	$1,669,500
Subtotal	$4,577,530
OH & P	$366,000
Subtotal	$4,943,530
Year Adjust	
ENR 2000	6221
ENR 2003	6733
Subtotal	$5,350,000
Location Adjust (Means 1998)	
Havre	94.4
Denver	93.7
Total	$5,390,000

Clearwell
Last Revision: January 26, 2004

Components: Two million gallon, two compartment concrete clearwell with a baffle wall in each compartment. Wetwells for High Service Pump Station are included with High Service Pump Station Cost

Civil	$190,000	
Architectural	$0	
Structural	$1,351,000	
Process	$85,000	
Mechanical	$0	
Elect/Instr.	$30,000	
Subtotal	$1,656,000	
OH & P	$132,000	8%
Subtotal	$1,788,000	
Year Adjust		
ENR 2000	6221	
ENR 2003	6733	
Subtotal	$1,935,000	
Location Adjust (Means 1998)		
Havre	94.4	
Denver	93.7	
Total	$1,949,000	

High Service Pump Station
Last Revision: May 10, 2004

Components: 6 High Service Pumps

Civil	$30,000
Architectural	$287,000
Structural	$173,000
Process	$1,750,350
Mechanical	$63,000
Elect/Instr.	$1,359,750
Subtotal	$3,663,100
OH & P	$293,000
Subtotal	$3,956,100

Year Adjust

ENR 2000	6221
ENR 2003	6733

Subtotal	$4,282,000

Location Adjust (Means 1998)

Havre	94.4
Denver	93.7

Total	$4,314,000

Chemical Building
Last Revision: May 10, 2004

Components: Alum/Ferric, Coagulant Polymer, Caustic Soda, Fluoride (dry), Filter Aid (dry), Sodium Hypochlorite (bulk liquid), Activated Carbon,

Civil	$45,000
Architectural	$1,021,000
Structural	$428,000
Process	$851,550
Mechanical	$287,000
Elect/Instr.	$643,650
Subtotal	$3,276,200
OH & P	$262,000
Subtotal	$3,538,200
Year Adjust	
ENR 2000	6221
ENR 2003	6733
Subtotal	$3,829,000
Location Adjust (Means 1998)	
Havre	94.4
Denver	93.7
Total	**$3,858,000**

Recovery Pump Station
Last Revision: May 10, 2004

Components: Two backwash recovery pumps, one filter to waste pump and one pump for pond overflow/drain

Civil	$55,000
Architectural	$147,000
Structural	$169,000
Process	$278,300
Mechanical	$90,300
Elect/Instr.	$210,000
Subtotal	$949,600
OH & P	$76,000
Subtotal	$1,025,600
Year Adjust	
ENR 2000	6221
ENR 2003	6733
Subtotal	$1,110,000
Location Adjust (Means 1998)	
Havre	94.4
Denver	93.7
Total	$1,118,000

Ponds
Last Revision: January 26, 2004

Components: Design for four ponds total. Two smaller (2 MG total) sludge ponds and two larger (5 MG total) backwash ponds. Assume worse case and the ponds have to be concrete lined. Assume 8-inch concrete thickness

Civil	$185,000	
Conc. Liner	$1,120,000	
Misc. Conc.	$60,000	
Process	$32,000	
Mechanical	--	
Elect/Instr.	$30,000	
Subtotal	$1,427,000	
OH & P	$114,000	8%
Subtotal	$1,541,000	
Year Adjust		
ENR 2000	6221	
ENR 2003	6733	
Subtotal	$1,668,000	
Location Adjust (Means 1998)		
Havre	94.4	
Billings	96.2	
Total	$1,637,000	

Administration/Maintenance Building
Last Revision: January 26, 2004

Components: Two offices, control room, unisex bathroom, lunchroom, locker rooms, laboratory, mechanical room, maintenance work area, two drive through maintenance bays

Administration Area

Civil	$3,000	
Architectural	$527,775	
Structural	$43,500	
Process	$0	
Mechanical	$88,500	
Elect/Instr.	$381,000	
Subtotal	$1,043,775	
OH & P	$0	included
Subtotal	$1,043,775	
Year Adjust		
ENR 2000	6221	
ENR 2003	6733	
Subtotal	$1,130,000	
Location Adjust (Means 1998)		
Havre	94.4	
Denver	93.7	
Total	$1,138,000	

Maintenance Area

Civil	$3,000	
Architectural	$63,500	
Structural	$80,300	
Process	$0	
Mechanical	$34,000	
Elect/Instr.	$40,000	
Subtotal	$220,800	
OH & P	$18,000	8%
Subtotal	$238,800	
Year Adjust		
ENR 2003	6733	
ENR 2003	6733	
Subtotal	$ 239,000	
Location Adjust (Means 1998)		
Havre	94.4	
Billings	96.2	
Total	$ 235,000	

Grand Total	$1,373,000

APPENDIX F

ACCOUNTABILITY REPORT

Value

Engineering

Accountability Report

ROCKY BOY'S/NORTH CENTRAL MONTANA REGIONAL WATER SYSTEM PLANNING / ENVIRONMENTAL REPORT

Conducted in Cooperation with Chippewa-Cree Tribe/Rocky Boy's Indian Reservation,
North Central Montana Regional Water Authority, State of Montana, Bureau of Indian
Affairs and Bureau of Reclamation, Great Plains Region, Montana Area Office

U.S. DEPARTMENT OF THE INTERIOR

MARCH 3, 1849

July 8, 2003

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HKM ENGINEERING

Table of Contents

Title **Page**

INTRODUCTION 1
SUMMARY OF VE PROPOSALS & RECOMMENDATIONS 1
DETAILED DISCUSSIONS 9
  VE Proposal No 1A 9
  VE Proposal No 1B-1 9
  VE Proposal No 1B-2 10
  VE Proposal No 1C 11
  VE Proposal No 1D 11
  VE Proposal No 2A-1 12
  VE Proposal No 2A-2 13
  VE Proposal No 2A-3 13
  VE Proposal No. 2B 13
  VE Proposal No 2C 14
  VE Proposal No 2D 14
  VE Proposal No 2E 15
  VE Proposal No 2F-1 15
  VE Proposal No 2F-2 16
  VE Proposal No 2G 16
  VE Proposal No 2H 17
  VE Proposal No 2I 17
  VE Proposal No 2J 18
  VE Proposal No 2K 18
  VE Proposal No 3A 19
  VE Proposal No's 3B and 3E 22
  VE Proposal No 3C 25
  VE Proposal No 3D 27
  VE Proposal No 3F 29
  VE Proposal No 3G 29
  VE Proposal No 3H 32

List of Figures

Title **Page**

Figure 3A1 South Tiber Realignment 20
Figure 3B1 Chester Realignment 24
Figure 3C1 Eagle Creek Colony Realignment 26
Figure 3D1 Riverview Colony Realignment 28
Figure 3G1 Fort Peck/Dry Prairie Pump Station Costs 31
Figure 3G2 North Central Pump Station Costs 31
Figure 3H1 Pipeline Sized for 24-Hour per Day Delivery 34

List of Tables

Title **Page**

Table 1 Disposition of VE Proposals 2
Table 2 Disposition of Items for Further Study 7
Table 3A1 Proposal 3A Pipeline Length and Cost Summary 21
Table 3A2 Proposal 3A Pump Information and Cost Summary 21
Table 3B1 Proposal 3B1 Pipeline Length and Cost Summary 23
Table 3H1 Pipe Length and Cost Information for the Core Pipeline 35
Table 3H2 Pipe Length and Cost Information for the Non-Core Pipeline 35
Table 3H3 Pump Power and Cost Information 36

INTRODUCTION

A Value Engineering (VE) study team convened the week of April 14-18, 2003 to evaluate the concepts presented in the Rocky Boy's/North Central Montana Regional Water System Planning/Environmental Report dated May 16, 2000. The VE study produced several proposals in an effort to reduce project costs and improve project functionality, which are summarized in a *Value Engineering Report* prepared by the U.S. Bureau of Reclamation. These proposals have been considered and evaluated by the project designers and sponsors, resulting in this *Accountability Report.*

SUMMARY OF VE PROPOSALS & RECOMMENDATIONS

The *Value Engineering Report* presents 27 'proposals' and contains 34 ‘items for further study’. The 'proposals' are ideas that were identified by the VE study team and are the only alternatives that were evaluated in terms of cost savings potential during the VE study. These proposals were segregated into three areas including (1) the raw water intake (proposals 1A – 1D), (2) the water treatment plant (proposals 2A – 2K), and (3) the storage, pumping and distribution system (proposals 3A – 3H).

The ‘items for additional study’ are ideas that the VE team determined to have merit for the project and are presented for further consideration by the designers. These concepts were not developed in as much detail as the proposals during the VE study and do not include cost analyses.

Table 1 summarizes the recommended actions for all of the VE proposals. The recommended action for each proposal is either acceptance, acceptance with conditions, or rejection. In the case of proposals that are either accepted or conditionally accepted, the final decision as to implementation will be made during preliminary design. These recommendations are most often based on technical feasibility, operational considerations and cost savings potential, as explained in further detail in the discussions immediately following the table.

Table 1 also includes the cost savings reported by the VE team and any adjustments to these cost savings suggested by the designers, where applicable. All costs have been adjusted to 1997 levels to match the cost estimates included in the original report. The worksheets used in the review of the VE proposals are included at the end of this document as Attachment A.

Table 2 summarizes the disposition of the ‘items for further study’ and categorizes them into (a) ideas that merit further evaluation and will be addressed in the FER, (b) ideas that merit further evaluation and will be addressed during preliminary design, and (c) ideas that do not merit further evaluation.

Table 1 Disposition of VE Proposals

roposal Number	Proposal Description	Accepted/ Rejected	VE Net Savings or Avoidances For Accepted Proposal	Design Team Estimated Net Savings or Avoidances$^{(2)}$	Comments
1A	Use micro-tunneling for intake lateral pipes in place of the previous intake concept in it's entirety	Accepted (tentatively)	\$2,455,000$^{(1)}$	\$2,984,000	Choice between proposal 1A, 1D, or original intake concept will be made upon further geotechnical investigations.
1B-1	Use 72-inch pressure line in right abutment of Tiber Dam as the source of water for the water treatment plant in place of the reservoir intake configuration	Rejected	\$3,458,000$^{(1)}$	N/A	Rejected due to questionable reliability and water quality concerns.
1B-2	Use 30-inch Tiber tap to river water treatment plant to serve relocated water treatment plant below the dam in place of lifting the water to the water treatment plant above the reservoir	Rejected	\$4,264,000$^{(1)}$	N/A	Rejected due to questionable reliability and water quality concerns.
1C	Move the intake structure and raw water pumps along the Marias River keeping them on federal lands in place of placing the intake into the Lake Elwell	Rejected	\$4,298,000$^{(1)}$	N/A	Rejected due to environmental concerns, lower water quality, additional pumping requirements, and fish screening concerns with the existing pipe inlet.
1D	Use direction drilling to create reservoir intake laterals, with inclined submersible vertical turbin pumps installed in each lateral to deliver water to the water treatment plant in place of the baseline intake and pump station facilities	Accepted (tentatively)	\$3,799,000$^{(1)}$	\$4,086,000	Choice between proposal 1A, 1D, or original intake concept will be made upon further geotechnical investigations.

roposal Number	Proposal Description	Accepted/ Rejected	VE Net Savings or Avoidances For Accepted Proposal	Design Team Estimated Net Savings or Avoidances(2)	Comments
2A-1	Relocate the high service pump station above the 2.0 MG buried reservoir in place of constructing its own building	Rejected	$22,000(1)	N/A	Rejected due to marginal cost savings and operational concerns.
2A-2	Locate the transfer pumps and high service pumps in a common structure/building connected to the water treatment facility in place of construction a separate building specifically for the high service pumps and associated equipment	Withdrawn	$8,000(1)	N/A	Withdrawn because Proposal 2A-3 was accepted.
2A-3	Use existing topography to allow the treated water to flow by gravity from the treatment process to the 2.0 MG reservoir in place of the clearwell and the transfer pumping facilities	Accepted (tentatively)	$606,000(1)	$243,000	Eliminates the need for a transfer pumping station will depend upon the topography of the site selected for the treatment plant.
2B	Change from chlorine as the secondary disinfectant to chloramines.	Accepted (tentatively)	$1,376,000(1)	$135,000	Disinfection by products will need to be investigated further when more detailed water quality data is available and the treatment process selected.
2C	Use gravity thickening and removable dewatering containers for solids removal in place of sludge drying lagoons	Rejected	$30,500(1) (w/thickeners) $281,000 (w/o thickeners)	N/A	Rejected due to marginal cost savings and additional operation and maintenance requirements.

Proposal Number	Proposal Description	Accepted/ Rejected	VE Net Savings or Avoidances For Accepted Proposal	Design Team Estimated Net Savings or Avoidances$^{(2)}$	Comments
2D	Use chlorine dioxide for pretreatment of the raw water in place of potassium permanganate	Accepted (tentatively)	0^{(1)}$	$0	Considered a better chemical to enhance filter performance, provide oxidation of iron and manganese, to provide pre-disinfecting, and for taste and odor control.
2E	Use geo-membrane liner for raw water storage/□resedimentation ponds in place of compacted gravel	Rejected	$561,000$^{(1)}$	N/A	Rejected due to additional cost of liner replacement in approximately 20 years.
2F-1	Use submerged membrane treatment in place of conventional treatment	Rejected	($1,500,000) $^{(1)}$	N/A	Rejected due to significant additional cost without significant additional value.
2F-2	Use pressure membranes and granulated activated carbon (GAC) contactors in place of conventional treatment facilities	Rejected	$2,512,000$^{(1)}$	($3,303,000)	Rejected due to additional raw water quality data obtained will require additional pre-treatment thus significantly increasing costs.
2G	Use either contact absorption clarifiers or high rate actiflo and media filters in place of baseline conventional water treatment plant	Rejected	$1,226,000$^{(1)}$	($2,498,000)	Rejected due to significant additional cost of proposal.
2H	Use direct filtration in place of the baseline conventional water treatment	Rejected	$3,079,000$^{(1)}$	N/A	Rejected due to additional raw water quality data obtained renders this proposal infeasible.
2I	Use a redundant intake in place of the pre-sedimentation basin	Accepted (tentatively)	$1,623,000$^{(1)}$	$1,212,000	Presedimentation basins will tend to degrade water quality in terms of disinfection by products.
2J	Use sludge lagoons in place of filter-to-waste recovery basin	Rejected	$629,500$^{(1)}$	N/A	Rejected due to potential to increase in THM formation

Proposal Number	Proposal Description	Accepted/ Rejected	VE Net Savings or Avoidances For Accepted Proposal	Design Team Estimated Net Savings or Avoidances[2]	Comments
2K	Operate water treatment plant 24 hours per day instead of 20 hours per day	Accepted (tentatively)	$2,782,000[1]	$2,782,000	Includes 5 percent for filter backwash and in-plant uses
3A	Serve users south of Tiber Reservoir by pipelines south of the reservoir by increasing pipe size to Tiber County Water District and extending pipeline to Conrad and Dutton in place of using 30-inch pipeline to Shelby and running pipeline going south along Interstate 15	Rejected	$9,402,935	($107,775)	Using Proposal 3H as the basis for comparison (24-hour vs. 20-hour per day operation), downsized a majority of the pipelines and makes this proposal questionable. If Cut Bank were to become part of the project, this alternative will need to be re-evaluated.
3B	Reroute transmission main to Chester along Highway 2 in place of routing northeast along the existing transmission main from Tiber Reservoir	Accepted (tentatively)	$274,100	Estimated cost savings included with Proposal 3E	Combined with Proposal 3E and includes downsizing associated with Proposal 3H.
3C	Reroute 4-inch pipeline to Eagle Creek Colony north from the transmission main to the Galata Water District in place of pipeline running west from the transmission main running north	Accepted (tentatively)	$1,200	$1,750	Will require routing the pipeline cross-country rather than following existing roads or right-of-way.

Proposal Number	Proposal Description	Accepted/ Rejected	VE Net Savings or Avoidances For Accepted Proposal	Design Team Estimated Net Savings or Avoidances(2)	Comments
3D	Reroute 4-inch pipeline to the Riverview Colony southeast from the transmission main to the Tiber Water District in place of south from the transmission main running east	Rejected	$6,000	($53,400)	No significant cost savings and adds a small pumping station and level of complexity.
3E	Route 30-inch pipeline north of treatment plant cross country northwest to Lothair and a 12-inch from Lothair east along Highway 2	Accepted (tentatively)	$2,548,000	$1,001,226	Combined with Proposal 3B and includes downsizing associated with Proposal 3H.
3F	Use 8-inch waterline to Galata Water District in place of 10-inch water line	Accepted (tentatively)	$295,600	Included with cost savings for Proposal 3H	Combined pipe sizing changes in Proposal 3H.
3G	Lower the number of booster stations and increase pump pressure in RG#5 and RG#7 in place of a higher number of booster stations and lower pipe pressure	Accepted (tentatively)	$601,393	$83,800	Will require exceeding the maximum pressures set in the original design criteria for approximately 54,000 feet of pipeline.
3H	Design the pumping and transmission system to deliver flows 24 hours per day in place of 20 hours per day	Accepted (tentatively)	$7,348,000(3)	$18,589,000	This proposal, once evaluated and sized, was used as the basis for evaluating all other distribution and pumping Proposals (3A – 3G).

(1) Compares original cost estimates at 1997 levels to proposal costs at 2003 levels.

(2) All costs adjusted to reflect 1997 levels.

(3) Only includes resizing the pipeline from the water treatment plant to the Rocky Boy's Indian Reservation boundary.

Table 2 Disposition of Items for Further Study

Number	Idea	Response
1	Use local operators to maintain chlorine residual	A
2	Facilities to clean screen with air	B
3	Build wind farms	C
4	Use natural gas with engines direct drive or generators	B
5	Use solar energy	B
6	Use natural gas for backup power	B
7	Use low energy systems treatment techniques	C
8	Optimize size or depths of raw water storage to keep degradation to a minimum	A
9	Install a wetland removal system on the incoming water to Lake Elwell	C
10	Evaluate backwash recycling	A
11	Evaluate blended water quality consideration	C
12	Evaluate disinfection alternatives, UV, ozone, etc.	A
13	Evaluate disinfection by products (DBP)	A & B
14	Use VFD's	B
15	Use variable speed drives (VFD's) in lieu of different size pumps	B
16	Use glass lined tank	B
17	Evaluate storage requirements	A
18	Evaluate tank alternatives	B
19	Re-evaluate water losses	A
20	Evaluate location and capacity of treated water storage	A
21	Revisit "C" values	A
22	Use polyurethane lining	B
23	Use larger diameter PVC pipe	A & B

Number	Idea	Response
24	Evaluate non-metallic pipe material	A & B
25	Lay pipe depth of buried in lieu of line and grade	B
26	Use VFD's	B
27	Underground/prefab pump/station	B
28	Only monitor, no control of remote locations	C
29	Multiple service shops	B
30	Evaluate system reliability (backup power, redundant systems, pumps, etc.)	B
31	Security issues	B
32	Avoid wetlands and environmental areas	B
33	Build mitigation measures into the proposed action	B
34	Evaluate pipe materials - Reservation	B

A. Idea merits further evaluation. Will be addressed in FER.
B. Idea merits further evaluation. Will be addressed during preliminary design.
C. Idea does not merit further discussion.

DETAILED DISCUSSIONS

This section of the report discusses in detail each of the proposals contained in the *Value Engineering Report.* The narratives below further explain the reasoning behind the recommendations presented in summary Table 1.

VE Proposal No 1A

Background:

The value study team proposed to use micro-tunneling for intake lateral pipes in place of the previous intake concept in its entirety. The estimated savings for this proposal was $2,455,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team concurs with this proposal, dependent on the results of additional investigations to determine the technical feasibility of this proposal. Either proposal 1A, 1D, or the original intake concept will be implemented depending upon further investigations. The feasibility of using micro-tunneling for the intake lateral pipes is contingent upon the suitability of the bedrock for micro-tunneling. The original geotechnical investigations for construction of the dam indicated that shale bedrock was present at the depths where the pipe laterals would be located. However, no data is available for the planned position of the intake upstream of the dam. Geotechnical investigations need to be conducted along the proposed micro-tunneling route to verify the bedrock characteristics.

If determined to be feasible, use of micro-tunneling allows construction of intake laterals at different elevations that would allow selecting the better water quality from the lake, depending on water quality variances with lake water depth. The use of multiple intake laterals also provides intake redundancy, permitting shutdown of individual laterals for maintenance purposes.

The design team has conferred with the client and has agreed to tentatively accept this proposal, dependent upon the results of geotechnical investigations of the bedrock material at the proposed intake location. The design team has conferred with the project sponsor and has agreed to tentatively accept this proposal. Our estimate of the savings is $ 2,984,000 and the implementation cost is $ 0. Therefore, the net estimated savings is $2,984,000.

VE Proposal No 1B-1

Background:

The value study team proposed to use 72-inch pressure line in right abutment of Tiber Dam as the source of water for the water treatment plant in place of the reservoir intake configuration. The estimated savings for this proposal was $3,458,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team does not concur with this proposal. The proposal was rejected due to the periodic shutdowns required for the 72-inch abutment pressure line for maintenance. The duration of the shutdowns are unknown, but at a minimum are expected to last one day. These shutdowns would require adding additional raw water or finished water storage to assure water system reliability during periods when the water supply to the water treatment plant is shutdown. Since the water system would not have control of the dam outlet works, it may not be practical to coordinate all shutdowns to occur at the most convenient time for the water system or restrict the frequency of their occurrence.

In addition, the abutment pipeline withdraws water from only the bottom of the reservoir, posing a water quality deterioration concern when lake turnover occurs in the spring and fall. Another concern is that the existing inlet to the abutment pipeline is not screened, allowing fish and debris to pass into the abutment pipeline and thus on to the water treatment plant. Both of these latter two issues could increase the treatment requirements at the water treatment plant, increasing the cost of the water treatment plant. The design team has conferred with the project sponsor and has reached an agreement to reject this proposal.

VE Proposal No 1B-2

Background:

The value study team proposed to use 30-inch Tiber Tap to river water treatment plant to serve relocated water treatment plant below the dam in place of lifting the water to the water treatment plant above the reservoir. The estimated savings for this proposal was $4,264,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team does not concur with this proposal. The proposal was rejected due to the periodic shutdowns required for the 30-inch reservoir tap line for maintenance. The duration of the shutdowns are unknown, but at a minimum are expected to last one day. These shutdowns would require adding additional raw water or finished water storage to assure water system reliability during periods when the water supply to the water treatment plant is shutdown. Since the water system would not have control of the dam outlet works, it may not be practical to coordinate all shutdowns to occur at the most convenient time for the water system or restrict the frequency of their occurrence. Another concern is that the 30-inch reservoir tap pipeline has never been pressurized and may have to be repaired or replaced if any deterioration has occurred. Due to the uncertainty of its condition, the need for maintenance shutdowns may be significant.

In addition, the reservoir pipeline withdraws water from only near the bottom of the reservoir, posing a water quality deterioration concern when lake turnover occurs in the spring and fall. Another concern is that the existing inlet to the reservoir tap is not screened, allowing fish and debris to pass into the pipeline and thus on to the water treatment plant. Both of these latter two issues could increase the treatment requirements at the water treatment plant, increasing the cost of the water treatment plant. The design team has conferred with the project sponsor and has reached an agreement to reject this proposal.

VE Proposal No 1C

Background:

The value study team proposed to move the intake structure and raw water pumps along the Marias river keeping it on federal lands in place of placing the intake into the Lake Elwell. The estimated savings for this proposal was $4,298,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team does not concur with this proposal. The proposal was rejected due to the following reasons:

- Potential ice blockage of the river intake during winter operation, particularly during low river flows.
- Lower quality of water due to bottom-only release of water from the reservoir outlets, especially during lake turnover events.
- Environmental concerns associated with locating the river intake in a recreational area and a fisheries habitat.
- Additional pumping head of approximately 200 feet required to lift the water to the elevation of the lake water surface (water elevation provided by above dam intakes).
- Fish screening requirements may require construction of a large structure to meet approach velocity limitations, significantly increasing construction cost of the proposal.
- Intake construction will disturb the riverbed and shoreline, requiring diversion of the stream to construct the facilities (COE 404 permit will be required).

The design team has conferred with the project sponsor and has reached an agreement to reject this proposal.

VE Proposal No 1D

Background:

The value study team proposed to use direction drilling to create reservoir intake laterals, with inclined submersible vertical turbine pumps installed in each lateral to deliver water to the water treatment plant in place of the baseline intake and pump station facilities. The estimated savings for this proposal was $3,799,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team concurs with this proposal, dependent on the results of additional investigations to determine the technical feasibility of this proposal. Either proposal 1A, 1D, or the original intake concept will be implemented depending upon further investigations. The feasibility of using directional drilling for the inclined intake lateral pipes is contingent upon the suitability of the bedrock for use of directional drilling and the feasibility of installing the submersible pumps in these inclined, curved pipes. The original geotechnical investigations for construction of the dam indicated that shale bedrock was present at the depths where the directional drilled pipes would be located. However, no data is available for the planned position of the intake upstream of the dam. Geotechnical investigations need to be conducted along the proposed directional drilling route to verify the bedrock characteristics.

A variation of this proposal would be to install the laterals on top of the lake bottom, following the slope at the shoreline. This approach has been used on other reservoir intakes at Fort Berthold and on a river intake at Glendive. This approach would require bank stabilization in the disturbed areas to protect the intake pipes. Based upon our preliminary investigations, we are not aware of any applications of directional drilling and submersible pumps used in this manner. Therefore, the feasibility of using submersible pumps with a curved intake pipe will need to be investigated. If this option is determined to be feasible, use of directional drilling allows construction of intake laterals at different elevations that would allow selecting the better water quality from the lake, depending on water quality variances with lake water depth. The use of multiple intake laterals also provides intake redundancy, permitting shutdown of individual laterals for maintenance purposes. The design team has conferred with the project sponsor and has agreed to tentatively accept this proposal. Our estimate of the savings is $4,086,000 and the implementation cost is $0. Therefore, the net estimated savings for this proposal is $4,086,000.

VE Proposal No 2A-1

Background:

The value study team proposed to relocate the high serve pump station above the 2.0 MG buried reservoir in place of constructing their own building. The estimated savings for this proposal was $22,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team does not concur with this proposal. The cost savings is minimal and precludes the construction of a lower cost above-grade clearwell, as a buried clearwell must be constructed with this proposal. In addition, should structural problems occur with the clearwell or maintenance cleaning be required inside the clearwell, the high service pump station cannot remain in service while the clearwell is drained down or repaired. The design team has conferred with the project sponsor and has reached an agreement to reject this proposal.

VE Proposal No 2A-2

Background:

The value study team proposed to locate the transfer pumps and high service pumps in a common structure/building connected to the water treatment facility in place of constructing a separate building specifically for the high service pumps and associated equipment. The estimated savings for this proposal was $8,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team considers this proposal withdrawn since Proposal 2A-3 was accepted, eliminating the need for the transfer pumps. The design team conferred with the project sponsor and has reached an agreement to withdraw this proposal.

VE Proposal No 2A-3

Background:

The value study team proposed that it incorporate into the water treatment process design that the existing topography be utilized to allow the treated water to flow by gravity from the treatment process to the 2.0 MG reservoir without the applications of pumps in place of the clearwell and the transfer pumping facilities. The estimated savings for this proposal was $606,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team tentatively accepts this proposal. The natural topography of the planned water treatment plant site may allow the use of gravity flow from the filters to the 2.0 MG storage tank, eliminating the need for the clearwell and transfer pumping. In addition, sufficient change in elevation may be available to permit the use of an above-grade 2.0 MG storage tank without compromising the plant gravity flow hydraulics. The final determination of this proposal will be dependent on the final water treatment plant site. The design team has conferred with the project sponsor and has agreed to accept this proposal. Our estimate of the savings is $243,000 and the implementation cost is $ 0. Therefore, the net estimated savings for this proposal is $243,000.

VE Proposal No. 2B

Background:

Change from using chlorine for secondary disinfection for the water transmission system to using chloramines. The disinfectant residual will last longer using chloramines than when using chlorine, reducing the need to booster the disinfectant residual at the booster pumping stations. The estimated cost savings of this proposal was $1,376,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team concurs with this proposal. However, the number of disinfectant booster locations that can be eliminated is subject to change, as the water quality from the reservoir is not well defined at this time so the decay rate for the chlorine and chloramines is not known. As a result, the cost savings from changing to chloramines may change as the expected water quality in the water transmission system becomes better defined, but should still result in a cost savings. Eliminating some of the chlorine booster stations at the booster pumping stations will also allow the use of buried pump facilities, possibly improving pump station security and reducing pump station costs (buried pump stations are included in the list of ideas for the study). The design team has conferred with the project sponsor and has agreed to accept this proposal. Our estimate of the savings is $135,000 and the implementation cost is $ 0. Therefore, the net estimated savings for this proposal is $135,000.

VE Proposal No 2C

Background:

The value study team proposed to use gravity thickening and removable dewatering containers for solids removal in place of sludge drying lagoons. The estimated savings for this proposal was with thickeners $30,500, without thickeners $281,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team does not concur with this proposal. The estimated cost savings estimated for this proposal (with the use of thickeners) is minimal and increases the operation costs of the water treatment plant due to the need to haul the dewatered sludge to the landfill on a regular basis. The sludge lagoons included in the original design concept require cleaning once every 1-2 years. The estimated cost savings estimated for this proposal (without the use of thickeners) is not realistic due to the need to provide dewaterable sludge to the dewatering containers. Sedimentation basin sludge from the water treatment plant will only be 0.1-0.25 percent solids, and will not dewater effectively in the dewatering containers. The design team has conferred with the project sponsor and has reached agreement to reject this proposal.

VE Proposal No 2D

Background:

The value study team proposed to use chlorine dioxide for pretreatment of the raw water in place of potassium permanganate. The estimated savings for this proposal was $0 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team tentatively concurs with this proposal, dependent on the results of additional water quality sampling and water treatment pilot testing, recommended as part of proposals 2F-2 and 2G. The use of chlorine dioxide in lieu of potassium permanganate potentially provides several potential treatment benefits, including:

- Improved oxidation of Fe/Mn in the raw water (Mn may be present due to lake stratification).
- Addition of inactivation of pathogens (i.e. Giardia, cryptosporidium, etc.) in the raw water.
- Kills algae in raw water, allowing easier removal in subsequent sedimentation process.
- Improves filter performance due to oxidation capability for particles in raw water.

The design team has conferred with the project sponsor and has agreed to tentatively accept this proposal. Our estimate of the savings for this proposal is $0 and the estimated cost to implement the proposal is $0 . Therefore, the net estimated savings for this proposal is $0.

VE Proposal No 2E

Background:

The value study team proposed to use geo-membrane liner for raw water storage/presedimentation ponds in place of compacted gravel. The estimated savings for this proposal was $561,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team does not concur with this proposal. The proposal was rejected because of the additional cost and the need to replace the liner in the future (liner life expectancy is 20 years). The design team has conferred with the project sponsor and has reached agreement to reject this proposal.

VE Proposal No 2F-1

Background:

The value study team proposed to use submerged membrane treatment in place of conventional treatment. The estimated additional cost for this proposal was $1,500,000 and the estimated cost to implement the proposal was $100,000.

Final Determination:

The design team does not concur with this proposal. The proposal was rejected because of the additional cost associated with the change to submerged membrane treatment. The raw water quality data available at this time does not indicate the need to provide the additional level of treatment provided by this proposal (i.e. high levels of turbidity or algae in raw water). The design team has conferred with the project sponsor and has reached an agreement to reject this proposal.

VE Proposal No 2F-2

Background:

The value study team proposed to use pressure membranes and GAC contactors in place of conventional treatment facilities (i.e. rapid mix, flocculation, sedimentation and filters). The estimated savings for this proposal was $2,512,000 and the estimated cost to implement the proposal was $100,000.

Final Determination:

The design team rejects this proposal since it is significantly more costly than the baseline proposal. Additional raw water quality data indicates that additional pre-treatment will be required due to higher turbidity and TOC values. The design team has conferred with the project sponsor and has agreed to tentatively accept this proposal. Our estimate of the savings is ($ 3,303,000) and the implementation cost is $ 0. Therefore, the net estimated savings to implement the proposal is ($3,303,000).

VE Proposal No 2G

Background:

The value study team proposed to use either contact absorption clarifiers or high rate actiflo and media filters in place of baseline conventional water treatment plant. The estimated savings for this proposal was using CAC process $1,226,000, using Actiflo process $1,408,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team rejects this proposal since it is significantly more costly than the baseline proposal. The design team has conferred with the project sponsor and has agreed to reject this proposal. Our estimate of the savings is ($2,498,000) and the implementation cost is $ 0. Therefore, the net estimated savings for this proposal is ($2,498,000).

VE Proposal No 2H

Background:

The value study team proposed to use direct filtration in place of the baseline conventional water treatment. The estimated savings for this proposal was $3,079,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team does not concur with this proposal. Upon obtaining additional raw water turbidity data obtained from the Bureau of Reclamation, this proposal does not appear to be feasible. The original proposal was based on the assumption that raw water turbidities would be between 5 and 10 NTUs with occasional excursions to about 50 NTUs. The new data indicates that turbidities above the 5 to 10 NTU range would be more common than expected and that peaks could be in excess of several hundred NTU. Additionally, TOC data indicates levels higher than would typically be treated using direct filtration. The design team has conferred with the project sponsor and has reached agreement to reject this proposal.

VE Proposal No 2I

Background:

The value study team proposed to use a redundant intake in place of the pre-sedimentation basin. The estimated savings for this proposal was $1,623,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team tentatively concurs with this proposal, dependent upon the following conditions:

- Obtain additional raw water quality data to confirm if pre-sedimentation is a benefit
- Conduct pilot testing of selected treatment processes to determine treatment benefits of pre-sedimentation
- Develop intake concept with sufficient redundancy to preclude the need to shut down the intake for maintenance

Due to the fact that the reservoir itself acts as a pre-sedimentation basin and provides the potential to degrade water quality rather than enhance water quality, the benefits of the pre-sedimentation basin are questionable. The particulate in the water is thought to be colloidal in nature and difficult to settle out. Therefore, the effectiveness of a pre-sedimentation basin is questionable. Additionally, an open raw water basin will have a tendency to increase the levels of algae. Due to the distances that this water will be pumped and the potential to generate disinfection byproducts, one of the major concerns and focus of the design should be to minimize their formation potential. For thesc reasons as well as the potential for cost savings, this proposal is recommended. The design team has conferred with the project sponsor and has reached agreement to tentatively accept this proposal. Our estimate of savings is $1,212,000 and the implementation costs is $ 0. Therefore, the net estimated savings from this proposal is $1,212,000.

VE Proposal No 2J

Background:

The value study team proposed to use sludge lagoons to recycle the decant and the water to head works in place of filter-to-waste recovery basin. The estimated savings for this proposal was $629,500 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team does not concur with this proposal. The proposal was rejected for the following reasons:

- The filter-to-waste (FTW) water will have minimal contaminants and will be degraded by storing the water in large open ponds prior to recycle.
- DBP formation is a critical concern for the water system, so maintaining the high quality of the FTW water will reduce THM functions in the recycle water.
- The FTW water can be used for non-potable water purposes at the water treatment plant due to its high quality (i.e. pump scale water, chemical system make-up water, irrigation water, etc.), avoiding use of finished water for these purposes.

The design team has conferred with the project sponsor and has reached an agreement to reject this proposal.

VE Proposal No 2K

Background:

The value study team proposed to operate water treatment plant 24 hours per day instead of 20 hours per day. The estimated savings for this proposal was $2,782,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team concurs with this proposal. The original concept of operating the water treatment plant 20 hours per day was done to account for down time and water use associated with filter backwash, in plant uses, and sludge blow down. The typical amount of water used for these purposes is normally 5 percent of the peak day water production. Additionally, treatment plants produce better quality water and are more efficient when operated continually unless being backwashed. Therefore, the treatment plant capacity should be set to account for this 5 percent water use for filter backwash, in plant uses, and sludge blow down. Other than filter backwash, the filters should be designed and should be operated continuously. The design team has conferred with the project sponsor and has agreed to tentatively accept this proposal. The savings for this proposal are estimated to be $ 2,782,000 and the implementation costs are $ 0. Therefore, the net estimated savings is estimated to be $ 2,782,000.

VE Proposal No 3A

Background:

The value study team proposed to serve users south of Tiber Reservoir by pipelines south of the reservoir by increasing pipe size to Tiber County Water District and extending pipeline to Conrad and Dutton in place of using 30-inch pipeline to Shelby and running pipeline going south along Interstate 15. The estimated savings for this proposal was $9,402,935 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team does not concur with this proposal, and has further studied the proposal to optimize the pipeline routing/sizing through the Tiber County Water District. In addition, the pipe sizing for the pipelines to the north/northwest of the reservoir have been optimized.

Modeling was performed for this proposal using pipelines sized for a 24-hour day (VE Proposal 3H) as the base model for estimating cost savings. The base model is discussed in Proposal 3H and has reduced many of the system's the pipe sizes from the model that was used as the basis of the Value Engineering Study. The proposal requires the South Tiber water transmission pipeline to increase in size from 8-inch to 18-inch. The 18-inch pipeline continues past the Tiber to where it branches on Solid Road. The branch to Conrad is a 14-inch in diameter, while the branch to Dutton is a 6-inch in diameter. The changes in pipe lengths relative to the pipe diameter and the associated cost change is presented in Table 3A1. The total length of pipeline for this proposal is about 840 feet greater than the base model, but because the many pipes have a smaller diameter, the estimated pipe costs for Proposal 3A is $168,945 less than the base model.

For the system pressure of this proposal to remain within the criteria of 35 to 200 psi, three additional pump stations are added to this proposal (see Figure 3A1). These pump stations have power requirements of 170, 12, and 25 horsepower. In addition, several of the base model's pump station power requirements have changed. This information, along with the cost estimation is presented in Table 3A2. The costs for new pump stations and the modifications in costs due to changed power requirements are based upon cost curves from Appendix A-5 of the *North Central Montana Regional Water System Appraisal Level Study*. This report estimates the cost of pump stations between 0 and 60 horsepower based upon pumping power (in horsepower) while the cost of larger pumps are estimated based upon flow.

Figure 3A1 South Tiber Realignment

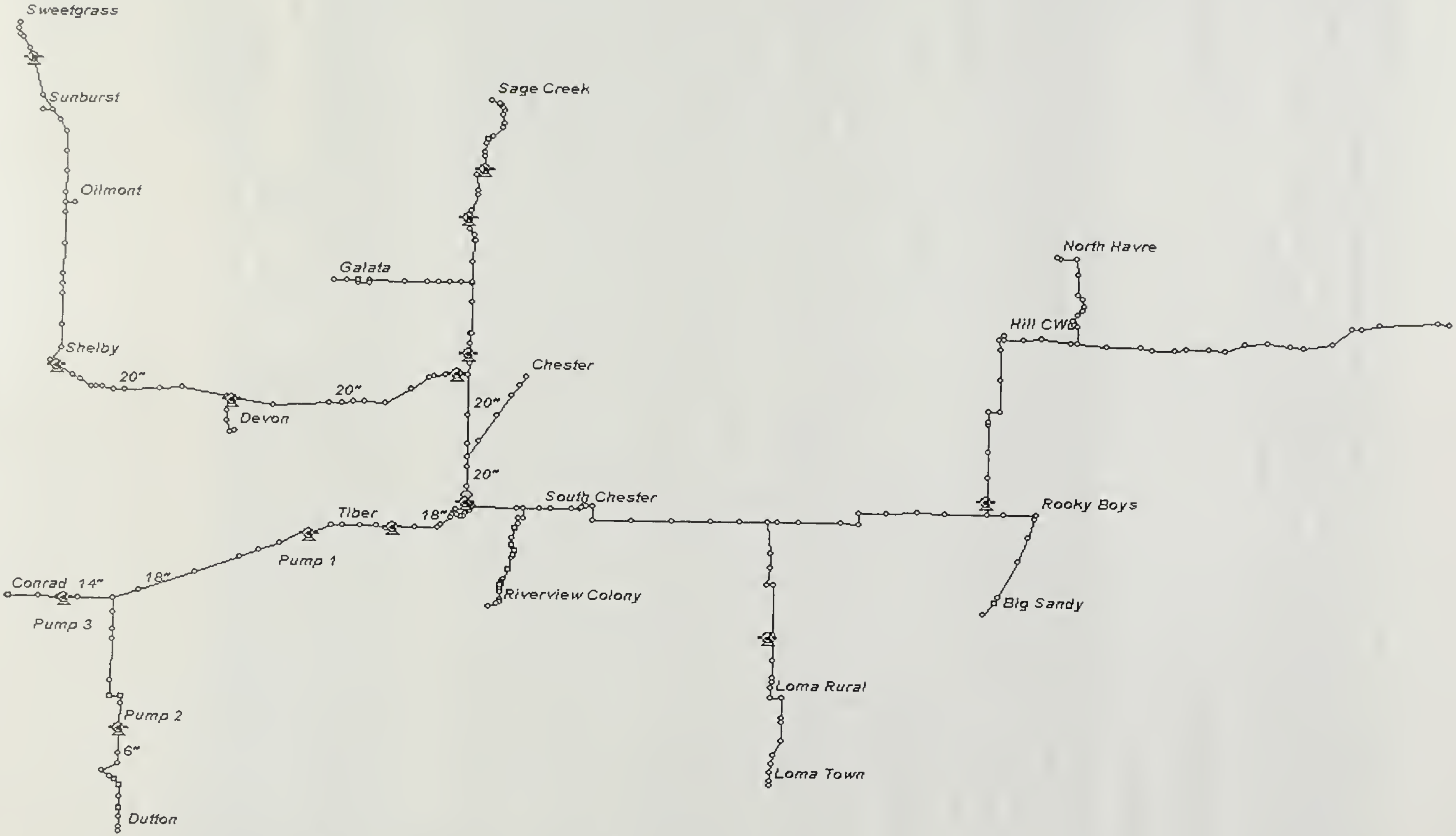


Table 3A1 Proposal 3A Pipeline Length and Cost Summary

diam.	Unit Price	Base Model Lengths (ft)	Base Model Pipe Costs	3A model lengths	3A Pipe Cost	Pipe Length Difference	Cost Difference
4"	$3.23	79,860	$257,949	79,276	$256,062	-584	-$1,887
6"	$5.46	132,599	$723,990	241,399	$1,318,038	108,800	$594,048
8"	$7.00	319,941	$2,239,587	261,363	$1,829,542	-58,578	-$410,045
10"	$10.41	282,503	$2,940,855	153,044	$1,593,184	-129,459	-$1,347,671
12"	$14.00	423,858	$5,934,017	420,537	$5,887,514	-3,322	-$46,503
14"	$26.00	83,662	$2,175,207	132,670	$3,449,419	49,008	$1,274,212
16"	$34.00	46,782	$1,590,574	0	$0	-46,782	-$1,590,574
18"	$38.00	93,081	$3,537,077	266,920	$10,142,972	173,839	$6,605,895
20"	$42.00	0	$0	180,529	$7,582,237	180,529	$7,582,237
24"	$47.00	484,649	$22,778,524	212,510	$9,987,989	-272,139	-$12,790,534
30"	$80.00	60,924	$4,873,919	60,447	$4,835,796	-477	-$38,123
Total		**2,007,859**	**$47,051,699**	**2,008,696**	**$46,882,754**	**837**	**-$168,945**

Table 3A2 Proposal 3A Pump Information and Cost Summary

	Proposal 3A Model			Base Model			
Name of Pump	Power (HP)	Flow (GPM)	Pump Cost	Power (HP)	Flow (GPM)	Pump Cost	Cost Difference
Pmp-TCWD	180	2,258	$456,454	40	438	138,901	$317,553
Pump 1	170	1,819	$430,133	0	0	$0	$430,133
Pump-1N	30		$112,628	35	388	125,740	-$13,111
Pump-1NW	7		$52,952	8	143	54,239	-$1,286
Pump 2	12		$65,836	0	0	$0	$65,836
Pump-1SW	0	0	$0	185	1,850	$432,103	-$432,103
Pump-2N	15		$73,591	15	160	73,591	$0
Pump-2W	130	2,653	$384,254	150	4,503	$585,872	-$201,618
Pump 3	25		$99,566	0	0	$0	$99,566
Pump-3N	17		$78,770	17	160	78,770	$0
Pump-3W	115	2,621	$476,324	375	4,472	$583,598	-$107,274
Pump-4W	105	2,468	$468,095	115	4,288	$570,621	-$102,525
Pump-E1	85	7,612	$1,040,067	85	5,793	$710,682	$329,385
Pump-HCWD	75	959	$365,733	75	959	$365,733	$0
Pump-Loma	15		$73,591	15	321	73,591	$0
Pump-W1	300	3,904	$546,022	300	5,754	$705,857	-$159,835
Total	**1,281**		**$4,724,016**	**1,415**		**$4,499,296**	**$224,720**

This proposal including the cost of the VE study of $52,000 using the 24-hour model as the base for the cost estimate, produces a $107,775 increase to the project and the implementation cost is $0. Therefore, the net estimated cost increase for this proposal is $107,775. The design team has conferred with the project sponsor and has agreed to reject this proposal.

Currently, Cut Bank is not a part of the North Central System but has requested to be included in the project. If Cut Bank were included in the project, the capacity of the pipeline to Shelby would need to significantly increased. Therefore, Proposal 3A should be re-evaluated if Cut Bank were proposed to be included in the project. It is very likely that splitting the flows north and south of Tiber reservoir would decrease the pipe diameter sufficiently to make this proposal cost effective.

VE Proposal No's 3B and 3E

Background:

The value study team proposed to reroute transmission main to Chester along Highway 2 in place of routing northeast along the existing transmission main from Tiber Reservoir to Chester along Highway 2. The estimated savings for this proposal was $274,100 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team concurs with this proposal. This proposal has been combined with Proposal 3E and is shown in Figure 3B1. Modeling was performed using pipelines sized for a 24-hour day as the base model for estimating cost savings. The base model is described in Proposal 3H and has reduced may of the system's pipe sizes from the model that was used as the basis of the Value Engineering meeting. The combined proposal reroutes the 24-inch transmission main cross-country from approximately 4.5 miles north of the treatment plant/intake area northwest to Lothair. A 14-inch water main continues north to serve Chester, Galata, and Sage Creek. The 10-inch water transmission main to Chester braches at Highway 2 and would follow the highway east to Chester rather than diagonally along the existing raw water pipeline right-of-way. The total length of pipe is about 8,700 feet less than the base model and total pipe cost savings is $937,500. Table 3B1 summarizes the pipe lengths and estimated costs.

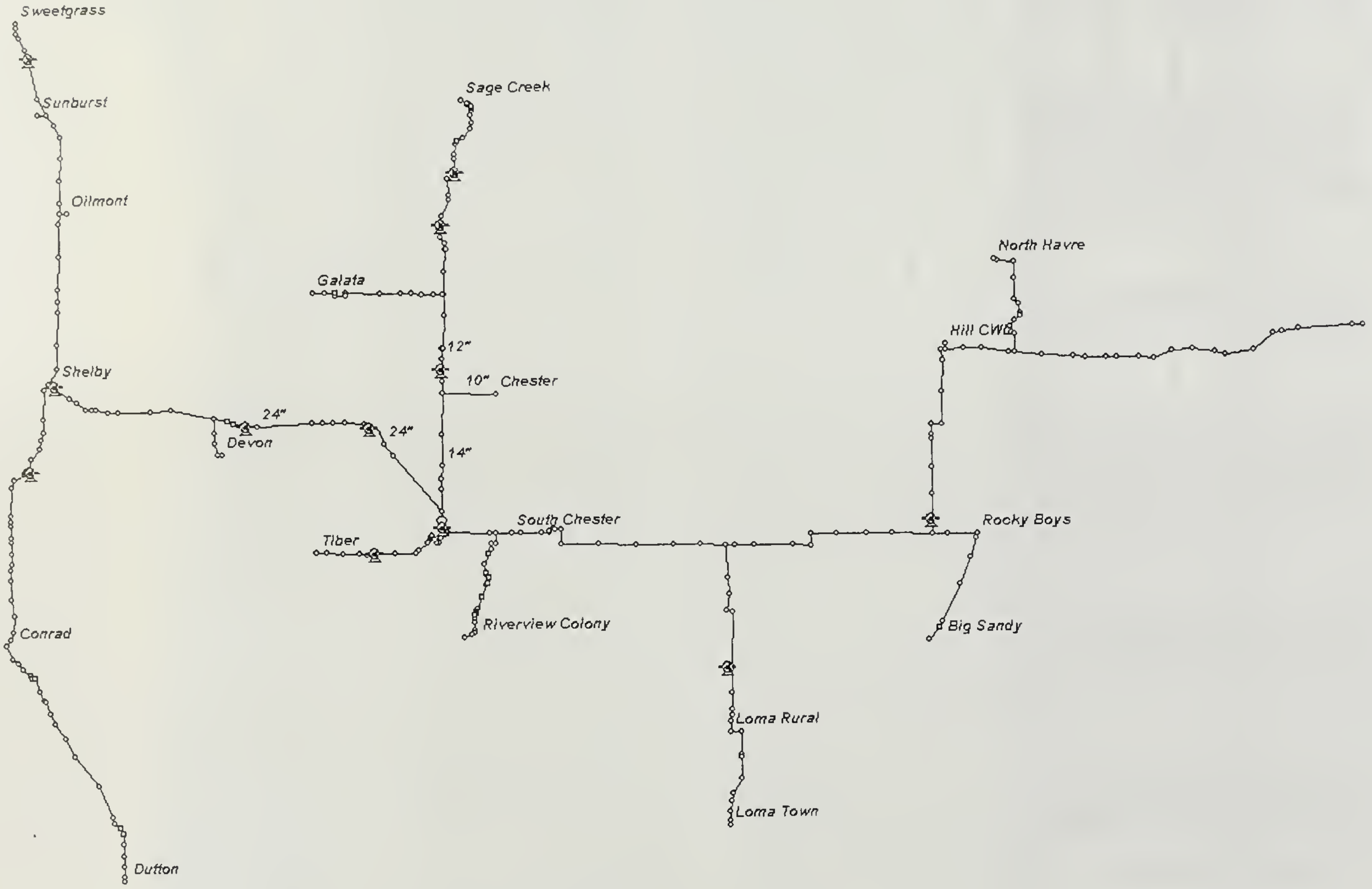
Due to the shorter length of pipe from the high service pumps (RG #1) to the RG #5 the hydraulic grade line at the pump station RG #5 is approximately 38 feet higher for this proposal compared to the base model. In addition, the location of RG #5 for Proposal 2B is about 30,500 feet nearer to the pump station RG #9, which translates into less friction losses in the pipes. These two factors allow RG #5 to be downsized from 150 horsepower to 50 horsepower. Using the cost curves developed in the *North Central Montana Regional Water System Appraisal Level Study* Appendix A-5, the cost savings for the downsized pumps is approximately $115,726. These cost curves are based upon power for pumps that are smaller than 60 horsepower and flow for pumps that are greater than 60 horsepower.

The design team has conferred with the project sponsor and has agreed to tentatively accept these proposals. Our estimate of the cost savings including the cost of the VE study of $52,000 is $1,001,226 and the implementation costs are estimated at $0. Therefore, the net estimated savings for this proposal is $1,001,226.

Table 3B1 Proposal 3B1 Pipeline Length and Cost Summary

Diameter	Unit Price	Base Model Lengths (ft)	Base Model Pipe Costs	Proposal 3B Lengths	Proposal 3B Pipe Cost	Pipe Length Difference	Cost Difference
4"	$3.23	79,860	$257,949	79,860	$257,949	0	$0
6"	$5.46	132,599	$723,990	132,599	$723,990	0	$0
8"	$7.00	319,941	$2,239,587	319,941	$2,239,587	0	$0
10"	$10.41	282,503	$2,940,855	308,567	$3,212,179	26,064	$271,324
12"	$14.00	423,858	$5,934,017	374,457	$5,242,402	-49,401	-$691,615
14"	$26.00	83,662	$2,175,207	141,100	$3,668,604	57,438	$1,493,397
16"	$34.00	46,782	$1,590,574	46,782	$1,590,574	0	$0
18"	$38.00	93,081	$3,537,077	93,081	$3,537,077	0	$0
24"	$47.00	484,649	$22,778,524	441,871	$20,767,953	-42,778	-$2,010,571
30"	$80.00	60,924	$4,873,919	60,924	$4,873,919	0	$0
Total		**2,007,859**	**$47,051,699**	**1,999,182**	**$46,114,233**	**-8,677**	**-$937,465**

Figure 3B1 Chester Realignment



VE Proposal No 3C

Background:

The value study team proposed to reroute 4-inch pipeline to the Eagle Creek Colony north from the transmission main to the Galata Water District in place of west from the transmission main running north. The estimated savings for this proposal was $1,200 and the estimated cost to implement the proposal was $0.

Final Determination:

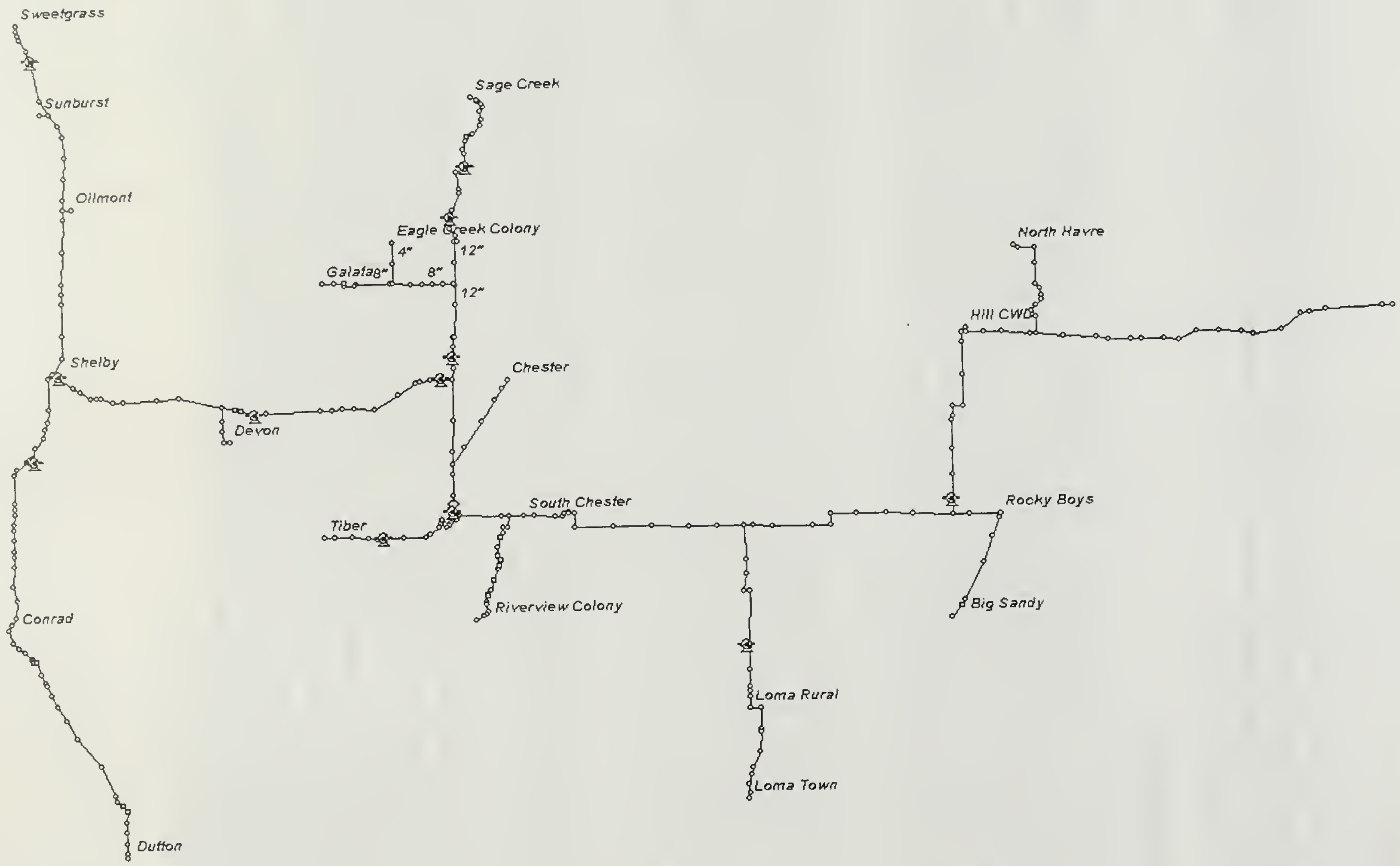
The design team concurs with this proposal. The alignment described in the Planning/Environmental Report to the Eagle Creek Colony consists of a 4-inch water transmission pipeline that is 30,400 feet long. This water transmission main was not included in the original model so it was included in the base model, which resizes the pipes for a 24-hour day and is described in Proposal 3H. This alignment is topographically high in elevation and a pump station will be required for the system pressure to remain within the defined criteria. This pump station would be approximately 1 horsepower.

The proposed realignment consists of a 4-inch water transmission main that branches from the Galata Water District water transmission main. This 4-inch line is 20,860 feet long. This proposal is lower in elevation than the original alignment and a pump station is not required. However, Eagle Creek Colony is high enough in elevation that Pump Station RG# 6 is required to be upsized from 35 horsepower to 42 horsepower. RG# 7, in turn, is downsized from 15 horsepower to 13.5 horsepower. The alignment is shown in Figure 3C1.

Pipeline cost are taken from Table 6 of the Planning/Environmental report for off-reservation pipe and non-core pipe unit costs. Pump costs are derived from the cost curves presented in Appendix A-5 in the North Central Montana Regional Water System Appraisal Level Study.

The cost of the alignment described in the Planning/Environmental report is approximately $98,192 for pipelines and $37,557 for the additional pump station. Total cost of the original alignment is $135,750. The pipeline cost of Proposal 3C is approximately $67,380. The estimated total cost (including life-cycle costs) of upsizing RG# 6 is $18,500 and the total cost of downsizing GR# 7 is approximately -$3,880. The total cost of Proposal 3C is approximately $82,000. The design team has conferred with the project sponsor and has agreed to tentatively accept this proposal. This proposal has an estimated cost savings including the cost of the VE study of $52,000 of $1,750 and an implementation cost of $0. Therefore, the net estimated savings for this proposal is $1,750.

Figure 3C1 Eagle Creek Colony Realignment



VE Proposal No 3D

Background:

The value study team proposed to reroute the 4-inch pipeline to the Riverview Colony north from the transmission main to the Tiber Water District in place of south from the transmission main running east. The estimated savings for this proposal was $6,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team does not concur with this proposal. The modeling was performed using pipelines sized for a 24-hour day as the base model for this proposal. The original alignment described in the Planning/Environmental report to the Riverview Colony Consists of a 4-inch water transmission main that braches off of the 30-inch transmission main east of the treatment plant. This line is approximately 59,100 feet long. Proposal 3D consists of a 4-inch transmission main that branches off of the Tiber Water District water transmission main. This alignment is approximately 47,100 feet long and is shown in Figure 3D1.

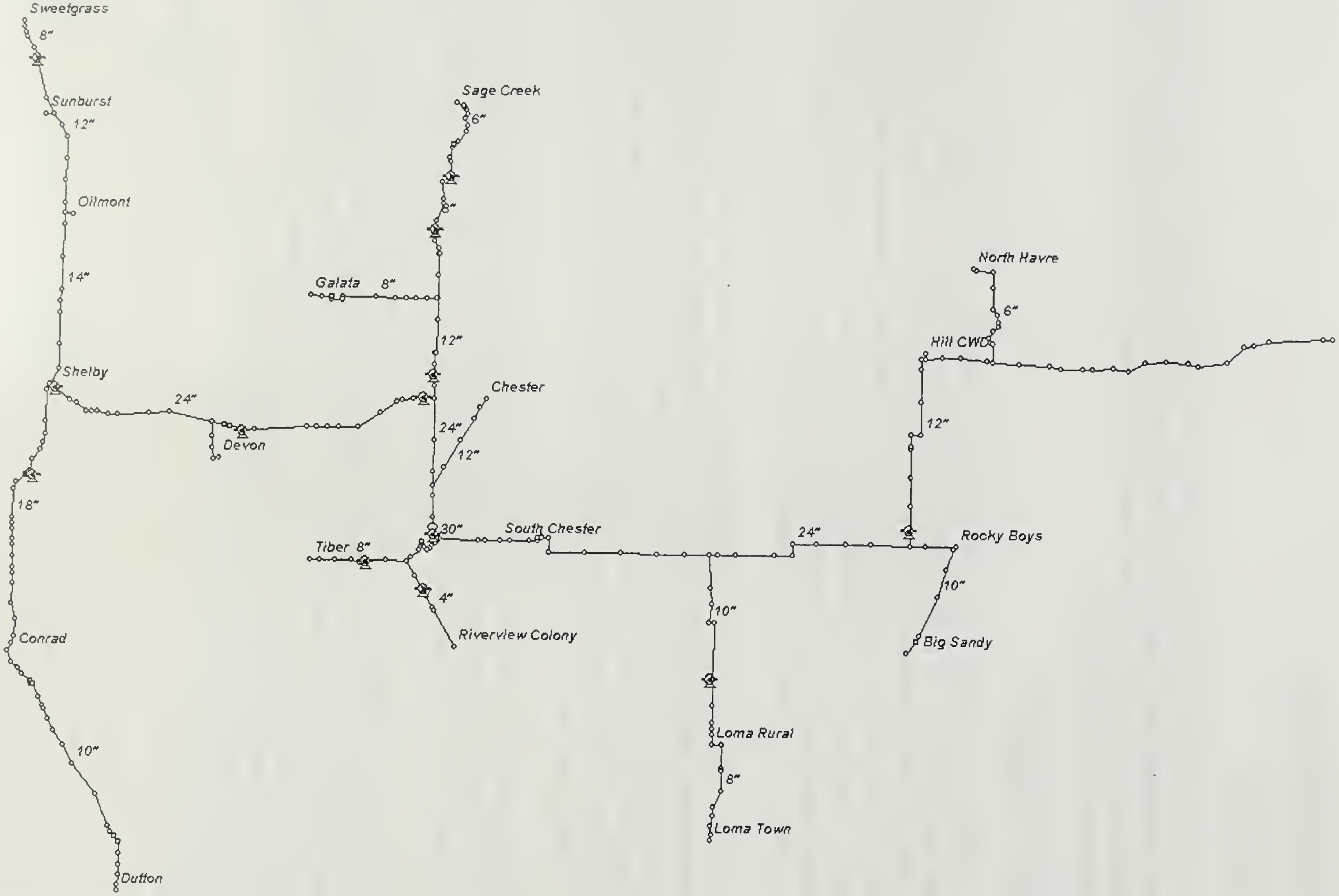
The Tiber Water District transmission main is more hydraulic constrictive than the 30-inch east transmission main. Because of this, the hydraulic grade line at the location of the Riverview Colony branch on the Tiber line is approximately 70 feet lower than location of the original Riverview Colony branch of the east line. Because of this and the high topography of the alignment, a 2 horsepower pump station is required on the Riverview Colony transmission main to keep the pressure within the criteria.

Pipeline cost are taken from Table 6 of the Planning/Environmental report for off-reservation pipe and non-core pipe unit costs. Pump costs are derived from the cost curves presented in Appendix A-5 in the North Central Montana Regional Water System Appraisal Level Study.

The cost of the original system is estimated at $190,900. The cost of Proposal 3D is estimated to be $152,171 for pipeline costs and $40,100 for the additional pump station. Total cost of Proposal 3D is approximately $192,300. The design team has conferred with the project sponsor and has agreed to tentatively accept this proposal. Our estimate of savings is including the cost of the VE study of $52,000 is -$53,400 and the implementation cost is $0. Therefore, the net estimated savings for this proposal is -$53,400.

Although the estimated cost savings is minimal, the proposal eliminates a pipe crossing of the Marias River. Changing the supply pipeline the 4-inch pipeline connects to (i.e. 30-inch core pipeline to the east vs. the Tiber Water District pipeline to the southwest as part of Proposal No. 3A) may impact the schedule for the 4-inch pipeline to Riverview Colony, as the 30-inch core pipeline will most likely be initiated in the initial phases of the project, well in advance of the Tiber Water District pipeline.

Figure 3D1 Riverview Colony Realignment



Since the cost can be considered equivalent for this proposal, the design team had to review other considerations to make a recommendation. This proposal would add a small pumping station in a remote area and therefore is not recommended because there was not a cost savings and it increases the level of complexity of the system for operation.

VE Proposal No 3F

Background:
The value study team proposed to use 8-inch water line to Galata Water District in place of 10-inch water line. The estimated savings for this proposal was $295,600 and the estimated cost to implement the proposal was $0.

Final Determination:
This proposal has been incorporated in Proposal 3H. This proposal sizes the pipelines to provide water for a 24-hour day as opposed to a 20-hour day. Modeling of Proposal 3H has downsized the Galata Water District water transmission main from a 10-inch to 8-inch. For the description and cost information, see Proposal 3H. The design team has conferred with the project sponsor and has agreed to tentatively accept this proposal.

VE Proposal No 3G

Background:

The value study team proposed to lower the number of booster stations and increase pump pressure in RG# 5 and RG#7 in place of a higher number of booster stations and lower pipe pressure. The estimated savings for this proposal was $601,393 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team concurs with this proposal and the project sponsors and funding agencies have accepted this proposal. The model where the pipelines are sized for a 24-hour day is used as the base model for this proposal. This base model is described in Proposal 3H.

This proposal deletes pump station RG# 9. In order to keep system pressure above the minimum criteria, the pumping power at pump stations RG# 5 and RG#10 are increased so that the lowest pressure in the respective pressure zones are no lower than 35 psi. Increasing the pumping power results in pressures that exceed the maximum design criteria of 200 psi for approximately 53,900 feet of the alignment. Therefore, a departure from design criteria for this proposal will need to be approved prior to final acceptance and implementation of this proposal. One of the keys to our recommendation of this proposal is the fact that there are not any significant customers along the pipeline where the higher pressures would be experienced.

It is proposed that class 350 ductile iron pipe is to be installed for the areas where the pressures exceed the maximum pressure criteria. Assuming that the installation and life-cycle cost are the same for 350-class ductile iron pipe, the current (6/27/2003) change in unit cost of 24-inch pipe is $4.23/ft. The corresponding 1997 change in unit cost is estimated to be $3.70/ft. The estimated change in price due to the increase in pipe class is approximately $199,700.

Pump station RG# 5 is increased from 150 horsepower to 500 horsepower in order to keep the minimum pressure in the respective pressure zone above 35 psi. Likewise, pump station RG# 10 is increased from 115 horsepower to 140 horsepower. The pump curves developed in the Appendix A-5 of the Appraisal Level Study are not applicable to this proposal because the cost curves of the large pumps are based upon flow and these pump's flow are constant. These cost curves do show a cost change even thought the power significantly increases. To address this issue, pump curves for capital costs were developed from data compiled in the Fort Peck/Dry Prairie Final Engineering Report (Table 7-8). These costs are based on power instead of flow. Life-cycle costs were estimated by developing cost curves from life-cycle data in the North-Central Planning/Environmental Report. These cost curves are shown in Figures 3G1 and 3G2. The increase in cost associated with upsizing RG#5 from 150 to 500 horsepower is estimated to be $212,000, while the estimated cost increase for upsizing RG#10 from 115 to 140 horsepower is $27,700. Cost saving for deleting pump station RG# 9 is $575,214 and is determined from Table 5 of the Planning/Environmental Report.

The design team has conferred with the project sponsor and has agreed to tentatively accept this proposal. Our estimate of the savings including the cost of the VE study of $52,000 is $83,800 and the implementation cost is $0. Therefore, the net estimated savings is $83,800.

Figure 3G1 Fort Peck/Dry Prairie Pump Station Costs

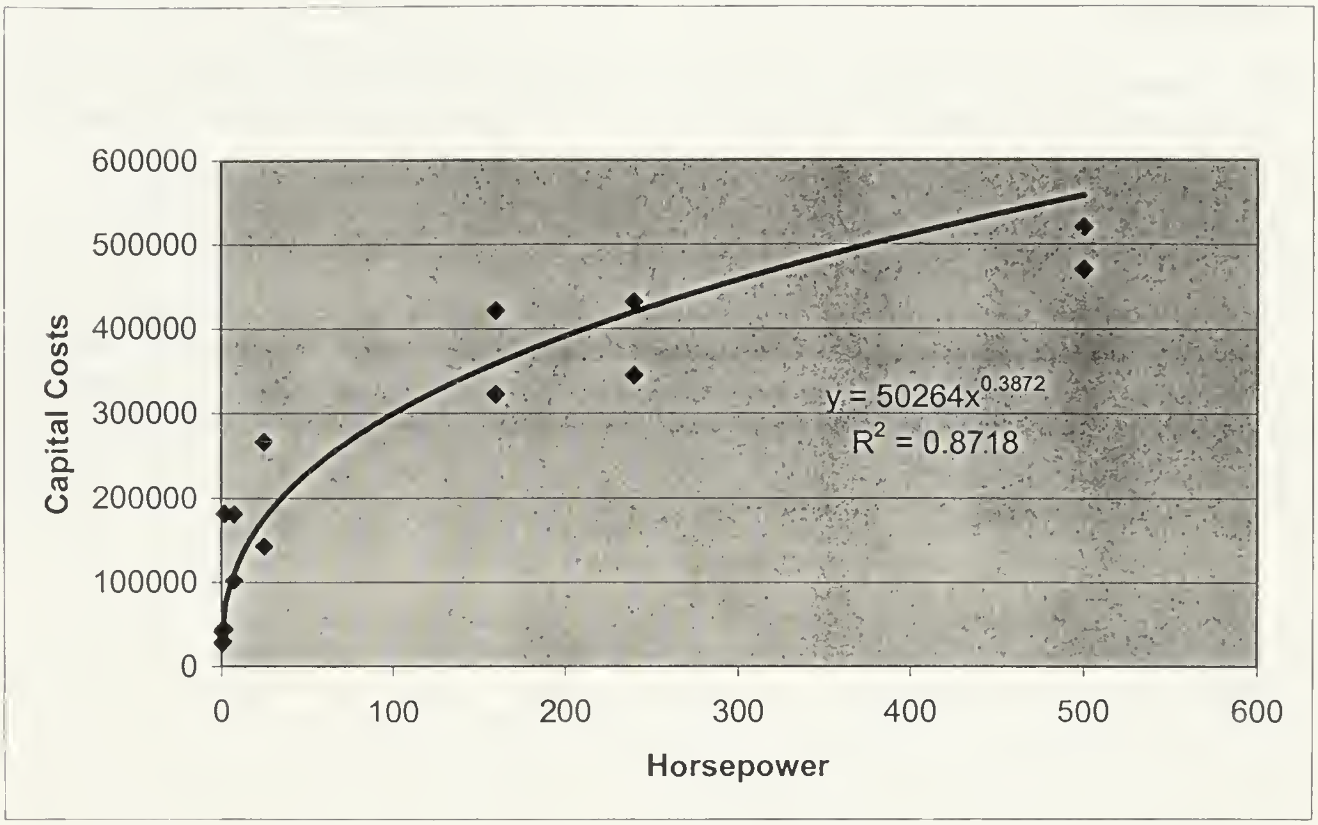
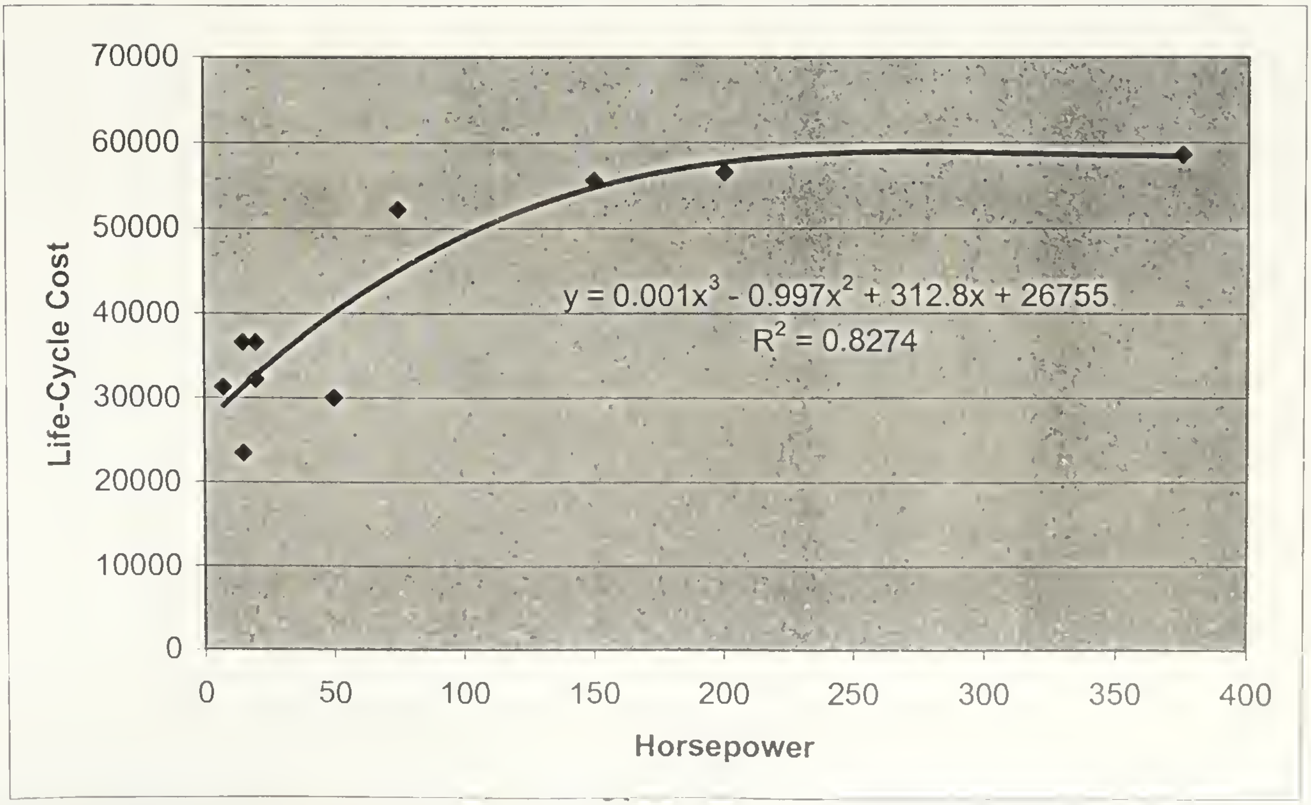


Figure 3G2 North Central Pump Station Costs



VE Proposal No 3H

Background:

The value study team proposed to design the pumping and transmission system to deliver flows 24 hours per day in place of 20 hours per day. The estimated savings for this proposal was $7,348,000 and the estimated cost to implement the proposal was $0.

Final Determination:

The design team concurs with this proposal. The pumping and distribution system should be sized to operate 24 hours per day provided that the pumping stations have backup pumps, the transmission system has enough storage to provide some level of service during an emergency situation, and the design criteria are met. The backup pumps will be included in the final design and provide the normal level of system redundancy. The design team has conferred with the project sponsor and has agreed to tentatively accept this proposal.

System demands have been modified in the model to reflect the water distribution over a 24-hour day. Effectively, all demands are multiplied by 20/24 or 0.833. The model was adjusted to optimize the pipes and pumps and so that the minimum pressure criteria of 35 psi and the maximum pressure criteria of 200 psi were met. Figure 3H1 shows the pipe sizes of the system based upon a 24-hour day, while the number in parentheses represent the pipe diameter of the model based upon a 20-hour day.

The change in cost of the core pipeline is determined by using the unit prices from Table 6 of the Planning/Environmental Report where the unit prices are developed from data with Indian project pipe costs included in the averages. The estimated pipeline cost change of the core system is -$6,575,500. Table 3H1 summarizes the pipe length and cost information of the core pipeline. The change in cost of the non-core pipelines are determined by using the unit prices from Table 6 of the Planning/Environmental Report where the unit prices are developed from data with out Indian project pipe costs included in the averages. The estimated pipeline cost change of the non-core system is -$12,331,900. Table 3H2 summarizes the pipe length and cost information of the non-core pipelines. The total pipeline cost change of this proposal is estimated to be -$18,907,400.

The change cost of the pumps is estimated using the cost curves developed in Appendix A-5 of the Appraisal Level Study for pumps under 60 horsepower. As with Proposal 3G, the cost curves developed for larger pumps in the Appraisal Level Study do not produce reasonable results because they are based upon flow and not power. To address this issue, pumps larger than 60 horsepower are priced according to cost curves developed for capital costs. This information was compiled from data in the Fort Peck/Dry Prairie Final Engineering Report (Table 7-8). These costs are based on power instead of flow. Life-cycle costs were estimated by developing cost curves from life-cycle data in the North-Central Planning/Environmental Report. These cost curves are shown in Proposal 3G in Figures 3G1 and 3G2. Table 3H3 summarizes the pump size and cost information. The total pump cost change is estimated to be $266,300.

The design team has conferred with the project sponsor and has agreed to tentatively accept this proposal. The emergency storage will need to be evaluated during the development of the FER. Our estimate of the savings including the cost of the VE study of $52,000 is $18,589,100 and the implementation cost is $0. Therefore, the net estimated savings is $18,589,100.

ure 3H1 Pipeline Sized for 24-Hour per Day Delivery

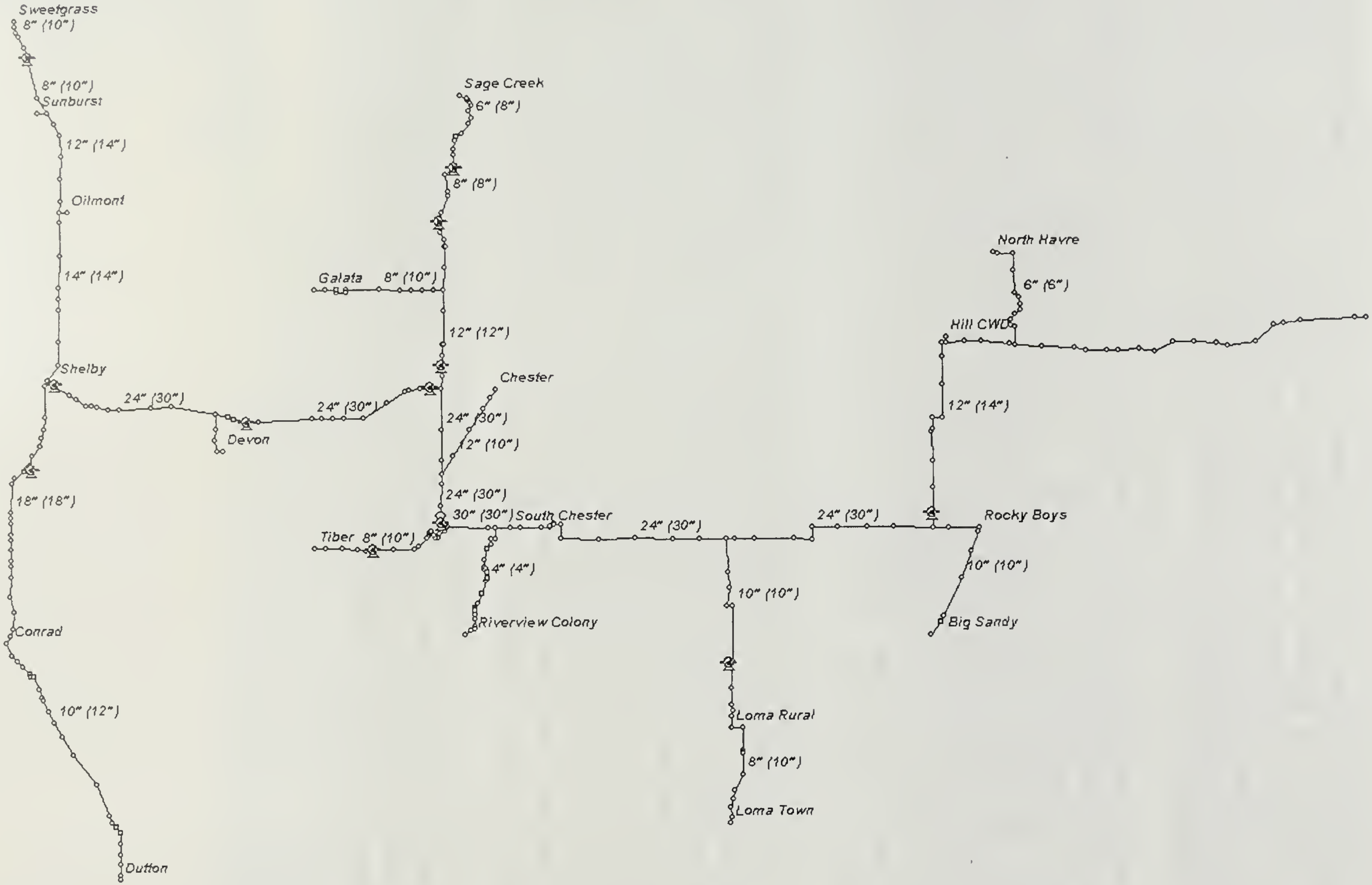


Table 3H1 Pipe Length and Cost Information for the Core Pipeline

Diameter	20 hr model lengths	Unit Price	20 Hour Pipe Costs	24 hr model lengths	Unit Price	24 Hour Pipe Cost	Pipe Length Change	Cost Change
4"	0	$4.12	$0	0	$4.12	$0	0	$0
6"	0	$6.19	$0	0	$6.19	$0	0	$0
8"	0	$8.05	$0	0	$8.05	$0	0	$0
10"	0	$10.41	$0	0	$10.41	$0	0	$0
12"	0	$17.66	$0	0	$17.66	$0	0	$0
14"	0	$26.33	$0	0	$26.33	$0	0	$0
16"	0	$34.00	$0	0	$34.00	$0	0	$0
18"	0	$38.00	$0	0	$38.00	$0	0	$0
24"	14,858	$47.00	$698,337	214,116	$47.00	$10,063,452	199,258	$9,365,115
30"	260,182	$80.00	$20,814,551	60,924	$80.00	$4,873,919	-199,258	-$15,940,633
Total	**275,040**		**$21,512,888**	**275,040**		**$14,937,371**	**0**	**-$6,575,517**

Table 3H2 Pipe Length and Cost Information for the Non-Core Pipeline

Diameter	20 hr model lengths	Unit Price	20 Hour Pipe Costs	24 hr model lengths	Unit Price	24 Hour Pipe Cost	Pipe Length Change	Cost Change
4"	79,860	$3.23	$257,949	79,860	$3.23	$257,949	0	$0
6"	90,405	$5.46	$493,611	132,599	$5.46	$723,990	42,194	$230,380
8"	108,419	$7.00	$758,932	319,941	$7.00	$2,239,587	211,522	$1,480,655
10"	395,329	$10.41	$4,115,373	282,503	$10.41	$2,940,855	-112,826	-$1,174,518
12"	416,115	$14.00	$5,825,614	423,858	$14.00	$5,934,017	7,743	$108,403
14"	232,295	$26.00	$6,039,676	83,662	$26.00	$2,175,207	-148,633	-$3,864,469
16"	0	$34.00	$0	46,782	$34.00	$1,590,574	46,782	$1,590,574
18"	139,863	$38.00	$5,314,777	93,081	$38.00	$3,537,077	-46,782	-$1,777,701
24"	0	$47.00	$0	270,460	$47.00	$12,711,620	270,460	$12,711,620
30"	270,461	$80.00	$21,636,840	0	$80.00	$0	-270,461	-$21,636,840
Total	**1,732,746**		**$44,442,772**	**1,732,746**		**$32,110,876**	**0**	**-$12,331,896**

Table 3H3 Pump Power and Cost Information

Name of Pump	20 Hr Model	Pump Flow	Pump Cost	24 Hr Model	Pump Flow	Pump Cost	Cost Difference
Pmp-TCWD	40	519	$138,901	40	438	$138,901	$0
Pump-1N	50	451	$165,371	35	388	$125,740	-$39,631
Pump-1NW	8	165	$54,239	8	143	$54,239	$0
Pump-1SW	200	2,235	$448,470	185	1,850	$436,240	-$12,230
Pump-2N	15	185	$73,591	15	160	$73,591	$0
Pump-2W	150	5,541	$404,433	150	4,503	$404,433	$0
Pump-3N	20	185	$86,554	17	160	$78,770	-$7,784
Pump-3W	375	5,397	$555,381	375	4,472	$555,381	$0
Pump-4W	75	5,160	$312,502	115	4,288	$366,697	$54,195
Pump-E1	75	6,960	$312,502	85	5,793	$327,509	$15,007
Pump-HCWD	20	1,151	$86,554	75	959	$312,502	$225,948
Pump-Loma	15	378	$73,591	15	321	$73,591	$0
Pump-W1	250	6,928	$484,591	300	5,754	$515,373	$30,782
Total	**1,293**		**$3,196,677**	**1,415**		**$3,462,965**	**$266,28**

Proposal 1A

Value Concept Cost

Laterals

Assume 36" is OK lateral size

Approximate depth of lower laterals		180 feet
Approximate depth of upper laterals		90 feet
Length of drill for lower laterals		400 feet
Length of drill for upper laterals		250 feet
Cost per foot	$	650 /foot
(based on cost curve from microtunnelling institute)		
Cost for Laterals	$	422,500

Caisson

Excavation		242000
Concrete		471000
Bottom		66000
Dewatering		100000
Cutting		50000
Caisson	$	929,000

Fish Screens

Each screen	$	75,000
(per email from Ed Donohough)		
Supports	$	30,000
Cost for Fish Screens	$	180,000

Sluice Gates

Gates	$	24,000
(Based on KC bid tab for 48" gate)		
Sluice Gates	$	72,000

Construction Cost	$	1,603,500	
Project Cost	$	2,084,550	Design Team Estimate

Original Baseline Cocept		$	4,857,000	1997 Dollars
Value Concept (VE Team)		$	2,350,000	
Value Concept (Design Team)	2003	$	2,084,550	2003 Dollars
Value Concept (Design Team)	1997	$	1,820,646	Adjusted to 1997 Dollars 14.5 %
Avoidance (VE Team)		$	2,507,000	
Avoidance (Design Team)		$	3,036,354	
Less VE cost			$52,000	
Net Avoidance (Design Team)			$2,984,354	

Proposal 1A

Value Concept Cost

Laterals

Assume 36" is OK lateral size

Approximate depth of lower laterals		180	feet
Approximate depth of upper laterals		90	feet
Length of drill for lower laterals		400	feet
Length of drill for upper laterals		250	feet
Cost per foot (based on cost curve from microtunnelling institute)	$	650	/foot
Cost for Laterals	$	422,500	

Caisson

Excavation		242000
Concrete		471000
Bottom		66000
Dewatering		100000
Cutting		50000
Caisson	$	929,000

Fish Screens

Each screen (per email from Ed Donohough)	$	75,000
Supports	$	30,000
Cost for Fish Screens	$	180,000

Sluice Gates

Gates (Based on KC bid tab for 48" gate)	$	24,000
Sluice Gates	$	72,000

Construction Cost	$	1,603,500	
Project Cost	$	2,084,550	Design Team Estimate

Original Baseline Cocept		$	4,857,000	1997 Dollars
Value Concept (VE Team)		$	2,350,000	
Value Concept (Design Team)	2003	$	2,084,550	2003 Dollars
Value Concept (Design Team)	1997	$	1,820,646	Adjusted to 1997 Dollars 14.5 %
Avoidance (VE Team)		$	2,507,000	
Avoidance (Design Team)		$	3,036,354	
Less VE cost			$52,000	
Net Avoidance (Design Team)			$2,984,354	

Proposal 2A3

Value Concept Cost

Remove Separate HSP Building

Assumed square footage		600	sf
(based on Staples Pump Station, reduced	$	300	/sf
	$	180,000	

Remove Transfer Pumps

Assume centrifugal low head		4	pumps
	$	20,000	each
	$	80,000	

Don't credit cost of clearwell

Construction Cost	$	**260,000**	
Project Cost	$	**338,000**	Design Team Estimate

VE Team	$	**606,000**	VE Team Estimate

Original Baseline Cocept	**$ 32,890,000**	1997 Dollars
Value Concept (VE Team)	**$ 32,232,000**	
Value Concept (Design Team)	**$ 32,594,791**	
Avoidance (VE Team)	**$ 658,000**	
Avoidance (Design Team)	**$ 295,209**	Adjusted to 1997 Dollars 14.5 %
Less VE cost	**$52,000**	
Net Avoidance (Design Team)	**$243,209**	

Proposal 2B

Value Concept Cost	
Ammonia Delivery System	
Metering Pumps	$ 20,000
Storage Tank	$ 100,000
Piping	$ 10,000
	$ 130,000
PW O&M	$ 300,000

Construction Cost	**$ 130,000**	
Project Cost	**$ 169,000**	Design Team Estimate
	$ 469,000	
VE Team	**$ 507,000**	VE Team Estimate

Baseline Concept (VE Team)	**$1,935,000**	(1)
Baseline Concept (Design Team)	**$ 682,941**	(2)
Value Concept (VE Team)	**$ 507,000**	
Value Concept (Design Team)	**$ 469,000**	2003 Dollars
Avoidance (VE Team)	**$1,428,000**	
Avoidance (Design Team)	**$ 186,856**	Adjusted to 1997 Dollars 14.5 %
Less VE cost	**$52,000**	
Net Avoidance (Design Team)	**$134,856**	

(1) Based on chlorine boosters at all 17 lift stations, checked cost based on tablet chlorination (used two recent Billings installations).

(2) Based on chlorine boosters at 6 lift stations. Some stations are close together and might not require boosters.

Proposal 2F2

Baseline Concept Cost	Design Cost	VE Cost	
Filter Media/UD Cost	$ 165,000		Guaranteed Cost for Leopold-10 mgd
with Installation	$ 247,500		
Cost for 20 mgd (straight line)	$ 495,000	$ 122,718	
Load at 66.7 %	$ 825,165	$ 204,571	
Remainder of Work	$ 9,027,432	$ 9,027,432	

Project Cost	**$ 9,852,597**	Design Team Estimate
VE Team	**$ 9,232,003**	VE Team Estimate

Value Concept Cost	Design Cost	VE Cost
Feed pumps	$ 100,000	$ 100,000
Screens	$ 200,000	$ 200,000
Membranes	$ 5,000,000	$ 5,000,000
GAC Contactors	$ 250,000	
Actiflo		$ 5,000,000
Reduced Plant Building	$ (700,000)	$ (700,000)
Reduced Plant I&C	$ (300,000)	$ (300,000)
Reduced Plant Chemical System Cost	$ (300,000)	$ (300,000)
Load at 66.7%	$ 4,250,000	$ 9,000,000
	$ 7,084,750	**$ 15,003,000**

Based on cent WQ data, GAC is not appropriate, and pre-sedimentation is required. Therefore, in the design review of this concept, GAC was replaced with sedimentation.

Original Baseline Cocept (VE Team)		$ 9,232,000	1997 Dollars
Baseline Concept (Design Team)		$ 9,852,597	
Value Concept (VE Team)		$ 7,084,750	
Value Concept (DesignTeam)	2003	$ 15,003,000	2003 Dollars
Value Concept (DesignTeam)	1997	$ 13,103,620	Adjusted to 1997 Dollars 14.5 %
Avoidance (VE Team)		$ 2,147,250	
Avoidance (Design Team)		$ (3,251,023)	
Less VE cost		**$52,000**	
Net Avoidance (Design Team)		**($3,303,023)**	

Proposal 2G

Value Concept Cost	Design Cost	VE Cost	
High Rate Clarifier Cost ($0.25/gallon per Kevni Kennedy)	$ 5,000,000	$ 1,602,369	Guaranteed Cost for Leopold-10 mgd
Filter Media Cost	$ 495,000	$ 122,718	
Subtotal	$ 5,495,000	$ 1,725,087	
Load at 66.7 %	$ 9,160,165	$ 2,875,720	
Remainder of Work	$ 4,921,250	$ 4,921,250	

Project Cost	$ 14,081,415	Design Team Estimate
VE Team	$ 7,796,970	VE Team Estimate

Need to add note in report that indicates with new WQ data, this proposal is less attractive, as more undesirable DBPs will be formed.

Original Baseline Cocept (VE Team)		$ 9,232,000	1997 Dollars
Baseline Concept (Design Team)		$ 9,852,597	
Value Concept (VE Team)		$ 7,772,000	Actiflo
Value Concept (Design Team)	2003	$ 14,081,415	Actiflo
Value Concept (Design Team)	1997	$ 12,298,708	Adjusted to 1997 Dollars 14.5 %
Avoidance (VE Team)		$ 1,460,000	
Avoidance (Design Team)		$ (2,446,111)	
Less VE cost		$52,000	
Net Avoidance (Design Team)		($2,498,111)	

Proposal 2I

Baseline Cost

Presedimentation Basin Costs

	15	mgd peak day demand
	3	days of storage
	45,000,000	gallons-raw water storage volume
	6,016,043	cf
	222,816	cy
$	5.00	/cy
$	1,114,082	

Construction Cost	$ 1,114,082	
Project Cost	$ 1,448,307	Design Team Estimate

VE Team	$ 1,875,000	VE Team Estimate

Value Concept Cost

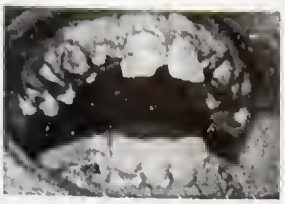
Length of additional Intake (using VE concept 1A)		250	ft
	$	650	/ft
Construction Cost	$	162,500	
Project Cost	$	211,250	Design Team Estimate

VE Team	$ 200,000	VE Team Estimate

Original Baseline Cocept (VE Team)		$ 1,875,000	2003 Dollars
Baseline Concept (Design Team)		$ 1,448,307	
Value Concept (VE Team)		$ 200,000	
Value Concept (Design Team)	2003	$ 211,250	2003 Dollars
Avoidance (VE Team)		$ 1,675,000	
Avoidance (Design Team)		$ 1,080,446	Adjusted to 1997 Dollars 14.5 %
Less VE cost		$52,000	
Net Avoidance (Design Team)		$1,028,446	

APPENDIX G

FLUORIDE FACT SHEET



Fluoridation

Facts, Fiction and Fiscal Responsibility

What is fluoridation?

Fluoridation is the process of adding supplemental fluoride to drinking water for the express purpose of preventing dental caries (tooth decay) in both children and adults. Fluoride is the 17th most common mineral in the earth's crust and is present at meaningful levels in all natural waters. Public health studies have shown that the optimal fluoride level for prevention of dental caries is approx. 1.2 mg/L (based on water consumption rates for children). Fluoridation is used only in waters where natural fluoride levels are less than this.

How does it work?

Fluoride helps to protect teeth by making the tooth enamel harder and more acid resistant. Dental caries is the result of bacterial growth on the teeth. The bacteria form plaques in hard-to-clean places and generate acid that dissolves the protective enamel of the tooth. Children are more susceptible to tooth decay, in part because they don't brush as frequently, but also because their diet is high in sugars that promote acid production.

The fluoride action is simple and straightforward. Ingested fluoride passes the intestinal wall and is distributed in the blood plasma to all parts of the body. However, it is retained only in bone structure, particularly the teeth.

In the tooth enamel the fluoride ion substitutes into the hydroxyapatite crystal structure that comprises the bulk of the enamel. This makes the enamel substantially harder and more acid resistant. In fact, without some level of fluoride, it is difficult for the body to remineralize and repair areas of tooth decay. The presence of fluoride in tooth enamel is the natural condition; it is an absence of fluoride that makes the enamel weak.

The tooth enamel also takes up fluoride directly from topical applications of fluoride in dental gels, and to a lesser degree toothpastes. However, this has been shown to be a less effective way of protecting children's teeth than drinking water supplementation, simply because the children that would benefit most are least likely to get the necessary dental care. Moreover, the topical applications can benefit only existing teeth, not teeth in their formative stages.

Fluoride Facts

- Fluoride is present at some level in all natural waters and foodstuffs.
- Over 150 million Americans drink fluoridated water.
- 42 of the 50 largest cities fluoridate their water.
- Grand Rapids, MI was the first utility to begin a fluoridation program (1945).
- Fluoride is fluoride. Whether natural or artificial the chemical behavior is the same.
- The normal diet contains less than a quarter of the desired fluoride intake.
- The Centers for Disease Control (CDC) has proclaimed fluoridation as one of the 10 greatest public health achievements of the 20th century.
- Fluoridation is highly recommended by the American Dental Association.

Fluoridation Benefits

- While tooth decay is an infectious disease that continues to be a significant oral health problem, the improvement in oral health associated with fluoridation is exceptional and undeniable. The latest (1993) and most credible review of 113 epidemiological studies spanning 23 countries shows that the range of reported decay reduction in fluoridated versus non-fluoridated water were:
  40 – 49% for baby teeth; and,
  50 – 59% for permanent teeth.
- Most studies have shown that relying on topical fluorides is insufficient to protect the developing teeth of children.
- The additional cost of dental care associated with unfluoridated waters has been shown to be 11% relative to decay restorative treatment, and 21% in terms of overall dental treatment.
- By far, the principal beneficiaries of fluoridation are children from less advantaged families without regular access to dental care.
- Every dollar spent on fluoridation saves $38 in dental costs.

Understanding the Opposition

It must be pointed out that there are adverse consequences associated with excessive fluoride consumption. Long-term exposure to drinking water fluoride concentrations above 5 mg/L can contribute to a condition called skeletal fluorosis, which actually embrittles the bones. Mottling of teeth (brown staining) can occur when too much fluoride is incorporated into the enamel, generally at drinking water fluoride levels above 3 mg/L. However, both conditions are entirely avoidable when fluoride levels are maintained within the optimal range (about 1.2 mg/L).

Any internet search of the fluoridation question will quickly show the depth of opposition – more than 50 websites can be found that purport to document the adverse health effects of fluoride, or describe the conspiracy they believe fluoridation to be. While there are certainly principled people that object to fluoridation on both philosophical and medical grounds, it is also clear that some opponents are misinformed and others have chosen to ignore the facts.

The arguments against fluoridation take a variety of forms; some of the more frequently used are listed below.

Fluoride is carcinogenic. All of the epidemiological studies that have specifically looked for a cancer association have proven negative.

The benefits of fluoridation have been wildly exaggerated and the risks have been downplayed. Not so. The benefits are exceedingly well documented (better than for any other water treatment program except chlorination), and the risks associated with excess fluoridation (dental and skeletal fluorosis) are well understood and completely avoidable with modest levels of operational care.

Fluoridation is not about protecting teeth; it is about the aluminum industry ridding itself of a hazardous waste for profit. This theory suggests that utilities are consciously conspiring with industry to harm the public. And, while it is true that fluoride compounds are a byproduct of aluminum smelting, most fluoride used to treat drinking water is mined specifically for that purpose. Moreover, all fluoride used in drinking water applications must pass National Sanitation Foundation (NSF) certification to ensure their potability.

Fluoridation is a program of forced medicatio There is truth to this argument. But, it can also argued that fluoridation is a form of nutrition supplementation, not unlike the addition of vitami to milk, bread and fruit drinks; iodine to table sa and both vitamins and minerals to breakfast cereals.

The Politics of Fluoridation

Fluoridation is a public health issue, but it is not a l or death choice. The issue for water utilities as whether to fluoridate is essentially a commun decision. The most compelling reason to fluoridate the substantial financial benefit that accrues to t community due to reduced dental care costs, coupl with the recognition that it is the most economica disadvantaged members of the community that w benefit the most.

Within any community there will be a relative small and vocal group that is adamantly opposed fluoridation. Because they are both passionate a vocal, they will dominate the public debate a media attention. Choosing to fluoridate will almo certainly generate some degree of ill will a unfavorable press towards the utility. It is likely th utilities considering fluoridation will be placed in t unfortunate position of having to decide whether suffer bad press and accusations, or whether to allo a small vocal group to have veto power over exceptionally cost-effective public program.

Fluoridation contributes more to oral healt
than just preventing tooth decay.
It also prevents needless infection, pain,
suffering and loss of teeth; it improves the
quality of life; and it saves significant sums o
money in dental treatment costs.

More Information

American Dental Association, Fluoridation Facts. Chicago, The Association;1999.

Centers for Disease Control and Prevention. Ten Great Public Health Achievements. United State 1900-1999. *MMWR Morb Mortal Wkly Rep*; 1999(12):241-242.

US Dept of Health & Human Services. *Fluoride: The Benefits Can Last A Lifetime.* Atlanta, GA: Centers for Disease Control, 1992. 2p.

APPENDIX H

NORTH CENTRAL SYSTEM COMMUNITY DEMANDS

APPENDIX H NORTH CENTRAL SYSTEM COMMUNITY DEMANDS

	Projected Community Information				Other Anticipated Demands			Design Life Demands			Total Demands w/Losses			
Design Year Demands	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Location	Population Growth (%)	End of Life Average Day Demand (gpd)1	Peaking Factor	End of Life Peak Day Demand (gpd)	Other Average Day Demands (gpd)2,3	Peaking Factor	Other Peak Day Demands (gpd)2,3	Design Life Average Day Demands (gpd)	Design Life Peak Day Demands (gpd)	Design Life Peaking Factor	10% Transmission System Losses (gpd)	Adjusted Average Day Demand (gpd)	Adjusted Peak Day Demands (gpd)	Adjusted Peaking Factor
Dutton	4.7%	63,300	2.48	157,000	11,600	1.64	19,000	74,900	176,000	2.35	7,490	82,390	183,490	2.23
Hill CWD	11.0%	291,000	1.79	521,000	45,800	2.02	92,500	336,800	613,500	1.82	33,680	370,480	647,180	1.75
N Havre	12.1%	39,200	2.14	84,000	22,900	1.39	31,900	62,100	115,900	1.87	6,210	68,310	122,110	1.79
Sage Creek	8.4%	56,000	2.09	117,000	37,000	1.49	55,000	93,000	172,000	1.85	9,300	102,300	181,300	1.77
Sage Creek Col	0.0%	14,900	2.69	40,100	0	N/A	0	14,900	40,100	2.69	1,490	16,390	41,590	2.54
Tiber	5.2%	158,000	4.00	632,000	170,000	1.37	233,000	328,000	865,000	2.64	32,800	360,800	897,800	2.49
Big Sandy	6.6%	213,000	3.75	799,000	10,900	1.05	11,400	223,900	810,400	3.62	22,390	246,290	832,790	3.38
Chester	21.2%	364,000	3.33	1,210,000	15,800	0.69	10,900	379,800	1,220,900	3.21	37,980	417,780	1,258,880	3.01
Conrad	22.7%	422,000	5.81	2,450,000	118,000	1.76	208,000	540,000	2,658,000	4.92	54,000	594,000	2,712,000	4.57
Devon	7.5%	25,800	3.13	80,600	45,400	1.52	68,800	71,200	149,400	2.10	7,120	78,320	156,520	2.00
Eagle Cr. Col	0.0%	14,900	2.69	40,100	0	N/A	0	14,900	40,100	2.69	1,490	16,390	41,590	2.54
Galata	5.7%	159,000	1.47	233,000	114,000	0.46	51,900	273,000	284,900	1.04	27,300	300,300	312,200	1.04
Loma Rural	9.9%	89,000	2.00	178,000	63,900	0.38	24,600	152,900	202,600	1.33	15,290	168,190	217,890	1.30
Loma Town	9.8%	59,700	3.64	217,000	0	N/A	0	59,700	217,000	3.63	5,970	65,670	222,970	3.40
Oilmont Rural	10.5%	88,400	2.70	239,000	77,300	0.79	60,900	165,700	299,900	1.81	16,570	182,270	316,470	1.74
Oilmont Town	10.5%	11,000	2.50	27,500	0	N/A	0	11,000	27,500	2.50	1,100	12,100	28,600	2.36
Riverview Col.	0.0%	14,900	2.69	40,100	0	N/A	0	14,900	40,100	2.69	1,490	16,390	41,590	2.54
S.Chester	5.4%	40,000	3.74	149,000	35,000	0.81	28,500	75,000	177,500	2.37	7,500	82,500	185,000	2.24
Shelby	22.2%	550,000	4.00	2,200,000	324,000	1.23	399,000	874,000	2,599,000	2.97	87,400	961,400	2,686,400	2.79
Sunburst	6.6%	117,000	3.82	447,000	18,400	0.29	5,310	135,400	452,310	3.34	13,540	148,940	465,850	3.13
Sweetgrass	5.2%	34,200	4.62	158,000	5,590	0.90	5,050	39,790	163,050	4.10	3,979	43,769	167,029	3.82
Kevin	10.0%	45,100	3.05	138,000	5,000	1.60	8,000	50,100	146,000	2.91	5,010	55,110	151,010	2.74
Cut Bank	22.2%	947,000	2.80	2,652,000	0	N/A	0	947,000	2,652,000	2.80	94,700	1,041,700	2,746,700	2.64
Subtotal	16.5%	3,820,000	2.62	10,000,000	1,120,000	1.17	1,310,000	4,940,000	14,100,000	2.85	494,000	5,430,000	14,600,000	2.69
Rocky Boy's	N/A	2,254,000	2.29	5,158,000	0	N/A	0	2,254,000	5,158,000	2.29	225,000	2,479,000	5,383,000	2.17
Total	N/A	6,070,000	2.50	15,200,000	1,120,000	1.17	1,310,000	7,190,000	19,300,000	2.68	719,000	7,910,000	20,000,000	2.53

Notes

1 End of Life Average Day Demand is equal to the population growth multiplied by the current Average Day Demand
2 Additional Anticipated Demands includes new users and individual requests, livestock use, and future commercial, and industrial demands
3 Demands are assumed to be equal to the demands identified in the Environmental Report
4 See Appendix H for expanded calculation table
5 Total raw water delivery will need to be 5 percent greater than total peak day demand to account for in-plant uses

Calculations

Column
A - Population Growth is calculated on Table 4-3 Population Projections.
B - End of Life Average Day Demand is calculated from multiplying the Historical Water Demands (Table 4-4) by Column A.
C - Projected Community Peaking Factors are assumed to be equal to the Historical Peaking Factor calculated in Table 4-4
D - End of Life Peak Day Demands are calculated by multiplying Column C by Column B.
E - Other Average Day Demands include demands listed in Assumptions 2 and 3.
F - Other Anticipated Demand Peaking Factors are calculated in the Environmental Report.
G - Other Peak Day Demands are calculated by multiplying the Column E by Column F.
H - Design Life Average Day Demands are calculated by adding Column B and Column E.
I - Design Life Peak Day Demands are calculated by adding Column D and Column G
J- Design Life Peaking Factors are calculated by dividing Column I by Column H.
K - 10% Distribution Losses are calculated by multiplying 10% to Column H.
L - Adjusted Average Day Demands are calculated by adding Column K and Column H.
M - Adjusted Peak Day Demands are calculated by adding Column K and Column I.
N - Adjusted Peaking Factors are calculated by dividing Column M by Column L.

APPENDIX I

WATER SYSTEM INFORMATION GATHERED BY MONTANA RURAL WATER SYSTEMS, INC.

APRIL 1, 2003

NORTH CENTRAL MONTANA REGIONAL WATER SYSTEM

Below figures are up-to-date of April 1, 2003.

System	Hook-ups	Average gallons per 1995 month	System Debt	with whom	Present Rates Base	Present Rates Variable	Peak Day System Demand	Avg Day System Demand winter	Additions to System since study by... Engineers in 1997	Contact Persons + Phone #'s	Other pertinent Data
Big Sandy	370	16,455	101,787	RD	$17.50	.85/-4000	750,000	200,000	New Well	John Field 378-2646	
Chester	475	19,254	672,983	RD Heritage Bk	$17.39	1.57/-2000	1,000,000	300,000	100,000 water tank lowered some water lines	John Kleinsassar 759-5635	Tonia Wickman clerk 759-5635
Conrad	1230	14,235	2,100,000	SRF	$28.31	2.02/-5000	2,000,000	250,000	Source Intake Treatment Plant	Steve Ruhd 271-3623	
Devon WUA	23	39,663	-0-	N/A	$90.00 flat rate		75,000	24,000	None	Art Adamson 432-3225	
Dutton	227	8,121	203,500	SRF BANK	$17.30	1.40/-2000				Troy Behm Operator 476-3311	
Galata CWD	110	41,488								Dean Lerum 432-2945	
Hill CWD	800	7,452			$40	$2/winter $1.50/Summer	470,000	200,000	500,000 Storage Tank ~~None~~ telemetry	Kim Bunton 372-3121	Corinna - call Fri. 4/18 Wayne Koopke 265-1461
Loma CWD	119	64,301	528,293	RD	$40 T $95 C		360,000	40,000	Anionic Poly Feed Radio Telemetry	Jim Cornell 739-4392 739-4216	System could increase with additional water
N Havre CWD	55	14,387	-0-	N/A	$125	$5/ 1.5gpm Restr	75,000	25,000	finance Anna Risman None 394-2354	Kevin Osterbarg 265-9340	200PSI at treatment plant office 265-4716
Oilmont CWD	80	41,823	-0-	N/A	$55 for 1.5gpm Restrict		216,000	80,000	None	Bob Tomsheck 737-2782 937-2835	System could increase by 12 hookups
Sage Creek CWD	80	19,649								Robert Dafoe 292-3597	John Cicon 292-3532
Shelby	1340	12,258	1,741,268	SRF	$14.00	$1/-2000 + 3000 3.02/-5000	1,800,000	450,000	Prison + tank.	Bill Moritz 434-5564	2,000,000 Peak estimate when Prison is full
S Chester WUA	32	61,776	-0-	N/A	$67.00	3.5gpm restrictor	142,000	38,000	1500 ft transmission line	Tom Osterman 759-5792	
Sunburst	135	27,040	115,000 559,000	Intercap RD	$37.12 flat rate		420,000	110,000	New well 150gpm 1999 Tank 420,000	Brian Roark office 937-2141	Art Pearson (test oper)
Sweetgrass CWD	55	17,976	-0-	N/A	$17.50	$4/-3500				Brian Roark Home 937-3681	Marianne Comstock 335-2211
Tiber CWD	350	22,600	$348770.12	GMAC	$24.08	1/2gpm Restr.	600,000	150,000	Nothing Major	Brad Pourrey office 278-5682	Robert Wolfe - Sec [illegible] 278-3288
Colonies	56										

CWD = County Water District
WUA = Water Users Association

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